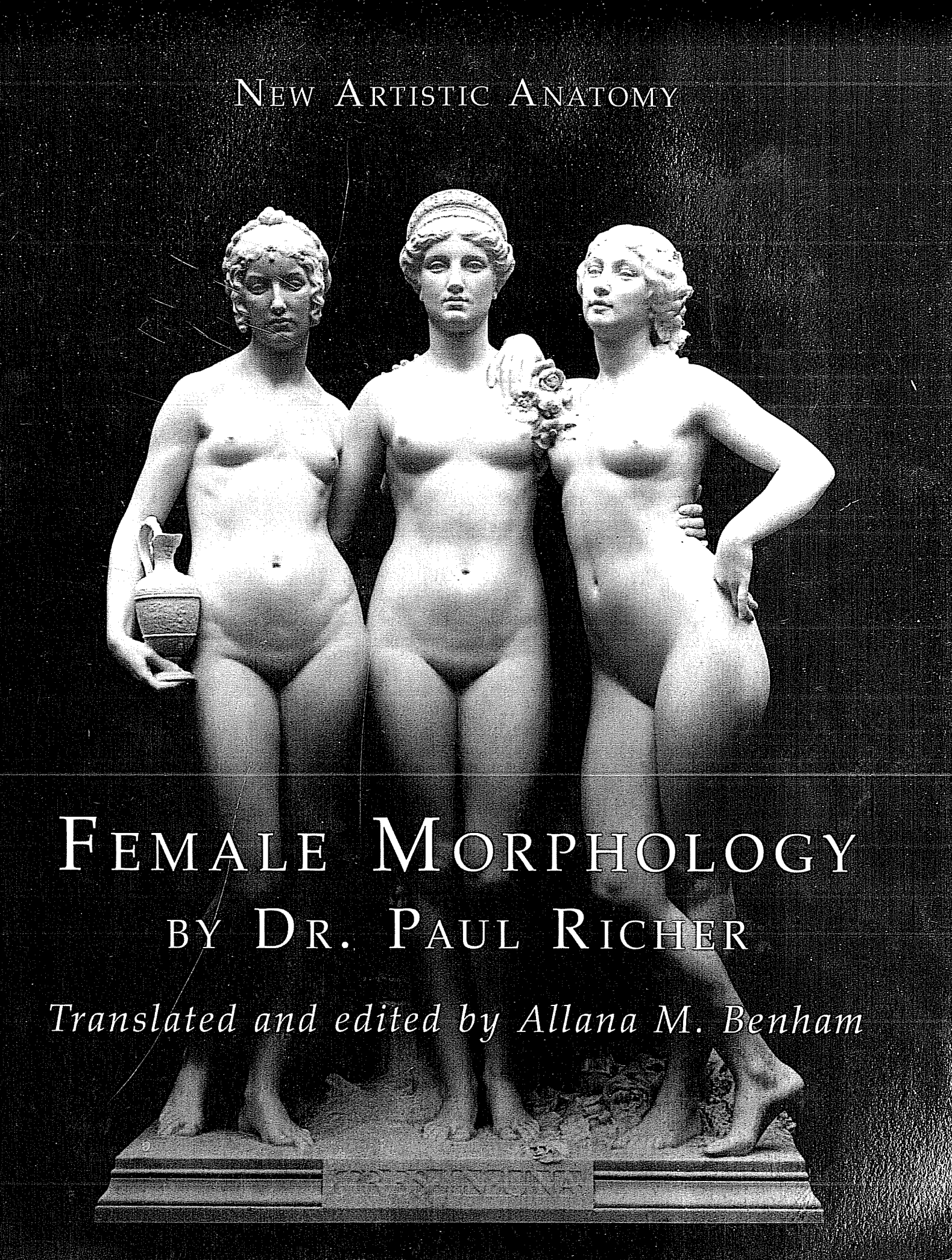
New Artistic Anatomy



Female Morphology

by Dr. Paul Richer

Translated and edited by Allana M. Benham

New Artistic Anatomy: Female Morphology

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This text was originally published in 1920 as
Nouvelle Anatomie Artistique, Volume II: Morphologie, la femme
by Plon, Nourrit et cie. Paris, France. It is now in public domain under French law according to section L123-1 of the Code de la propriété intellectuelle.

Published by Benham Books

ISBN-13: 978-0994731302

ISBN-10: 0994731302

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for Eva Claire

Acknowledgements

Profound thanks to the wonderful and inspiring instructors I had the pleasure of studying with at the New York Academy: Frank Porcu, Edward Schmidt, and the late Deane G. Keller. Your love of this subject sparked my curiosity and allowed me to recognize the wisdom contained in this text. Thanks to Isabelle Laforet for her insight and impeccable word choices, to Ashley Yazdani for her keen sense of style, and to Eliot Goldfinger for his sound advice. And, of course, my deepest gratitude to my husband Eric Mannella for his encouragement and support in all aspects of my creative life, and to my family, for pushing me to realize my dreams.

- Allana M. Benham

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GLOSSARY OF TERMS

These standard anatomical terms are important to describe position in the body and are frequently used in this text.

Anterior: toward the front surface of the body
Posterior: toward the back surface of the body

Dorsal: on the back surface of the body, or relating to the back of the hand or the top surface of the foot
Ventral: on the front surface of the body

Median: on the center line of the head or torso, anterior or posterior sides

Medial: toward the median line
Lateral: away from the median line

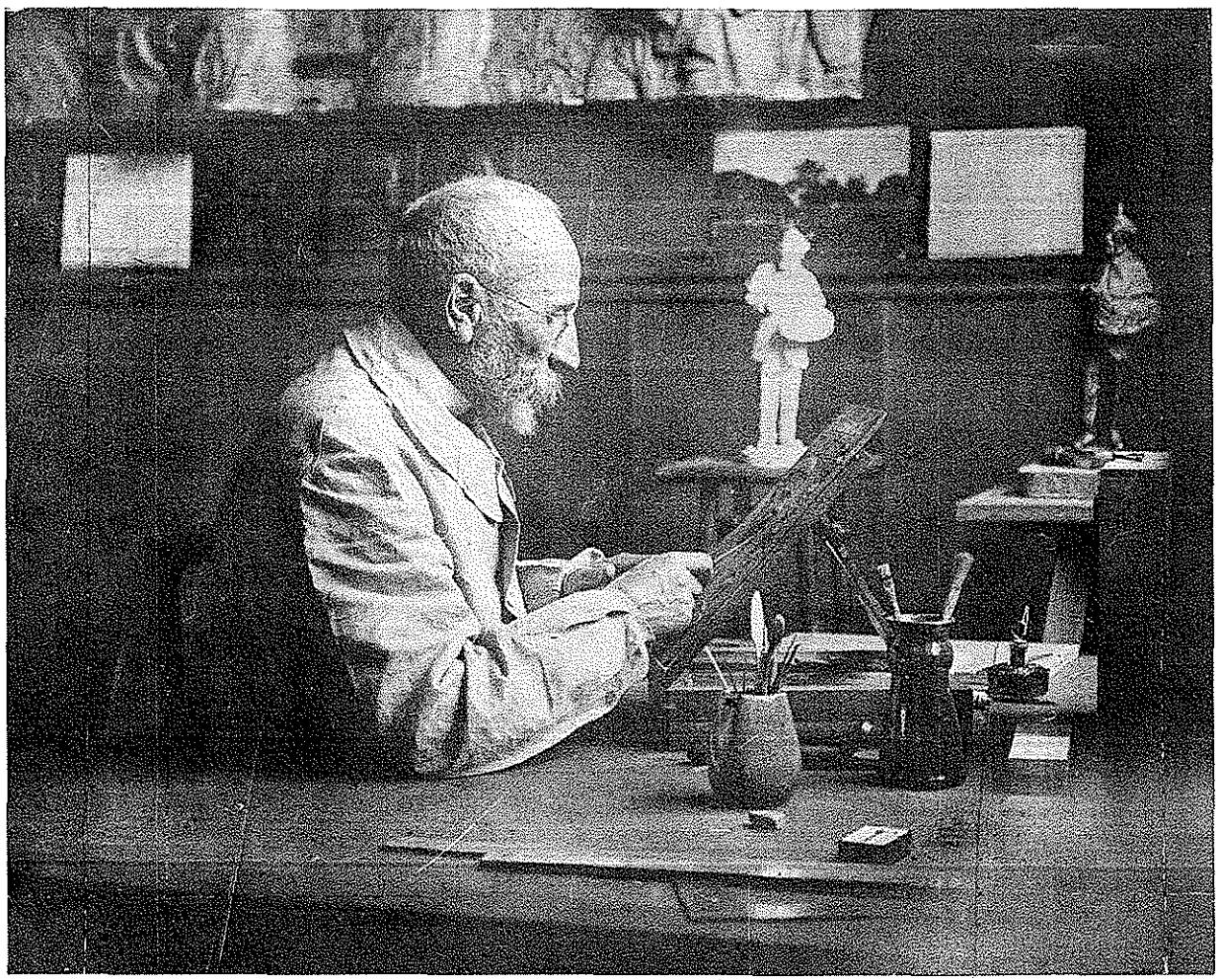
Note: Richer used the terms *internal* and *external* rather than medial and lateral. For the most part, I have chosen the latter because they are more definitive, although I did maintain his terminology in some places.

Superior: above, or towards the head
Inferior: below, or towards the foot

Proximal: at the upper end, or towards the torso
Distal: at the lower end, or towards the extremity

Supra- (prefix) : above, or towards the head
Infra- (prefix) : below, or towards the extremity

TRANSLATOR'S PREFACE



i. Paul Richer seated in his studio, date unknown. Collection of the École Nationale Supérieure des Beaux-Arts, Paris.

"Anatomy, Gerdy says, aids the eyes and makes the skin transparent, revealing the forms of the surface of the body to the artist through the memory of the parts hidden beneath the veil of flesh. Anatomy is like a magnifying glass that makes these forms visible in minute detail so that, clarified by it, the artist sees much more, sees much faster, and renders with greater fidelity the forms that are distinct to his eyes because they are clear in his mind."

- from Richer's *Anatomie Artistique*, 1890[1]

This is a monumental work by the father of modern artistic anatomy, Dr. Paul Richer (1849 – 1933), and deserves to be discovered by a new generation of artists and art students. Here, for the first time, Richer accurately and methodically describes the variety of normal physiology of the female body from an artist's perspective. This text is an essential compliment to the great number of anatomical texts that describe the male form, including Dr. Richer's own volumes on the subject. Richer's *Anatomie Artistique* (1890), which treats the male figure exclusively, has become a canonical work in the field of artistic anatomy.[2] *Morphologie: la Femme* was written to fill the void of information on the female form that had long existed. I am deeply honored to translate this important text into English for the first time since its original publication in 1920.

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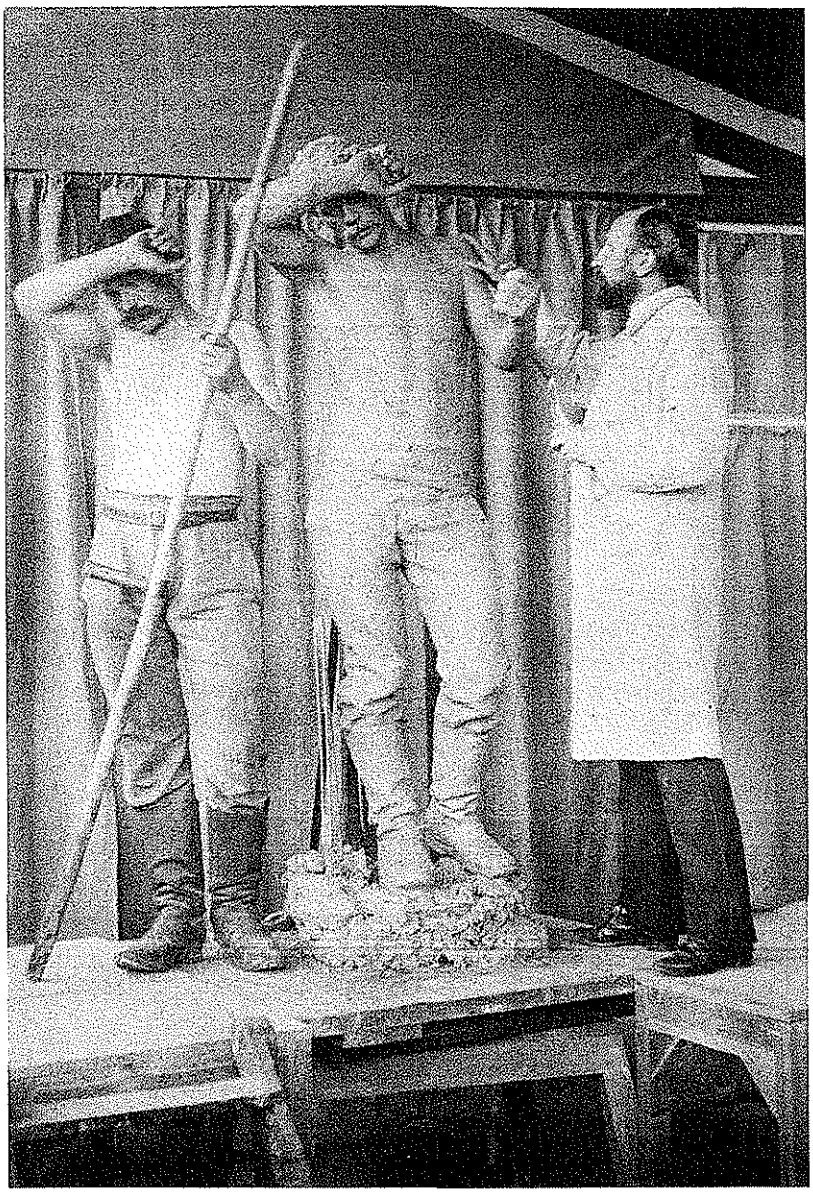
[1] P. Richer, *Anatomie Artistique*. Paris: E. Plon, Nourrit et cie, 1890. p. vii. Benham, translation.

[2] *ibid.*, and Dr. Paul Richer, *Artistic Anatomy*, translated by Robert Beverly Hale. New York: Watson-Guptill Press, 1971.



ii. Paul Richer sculpting from the live model, date and photographer unknown. Collection of the ÉNSBA, Paris.

Biographical Sketch

Dr. Richer was an accomplished sculptor and draughtsman in addition to being a practicing physician, scholar, and Professor of Anatomy and Drawing at the École des Beaux-Arts in Paris. Early in his career, his work focused on mental and physical illness, as would be expected of a young physician. He studied under Dr. Charcot, who is now considered to be the founder of modern neurology.[3] Richer became a medical doctor in 1879 and published his doctoral thesis in 1881 on his study of epilepsy, observed in his work at the Hôpital Salpêtrière in Paris. The following year, he was named *Chef de Laboratoire de la Clinique des maladies du système nerveux* at the Salpêtrière.[4] These formative experiences with the pathology of the body led him to research and define the human form in its opposite condition of health and balance. In the 1890's, he published several works that established his reputation as an instructor of artistic anatomy.[5] From 1903, Richer was the Chair of Artistic Anatomy at the École des Beaux-Arts, succeeding his teacher Dr. Mathias Duval. In 1922, just after publishing this text, he resigned his post at the École and was succeeded by his student, Dr. Henry Meige.

In the course of his professional career, Richer did not cease his own artistic production, which found its primary expression in the art of sculpture. Jules Dalou was a mentor, and Richer's work shows similar naturalistic tendencies. Richer worked in many formats; he was equally facile making bronze medals, portrait busts, and lifesize figures. He exhibited many times in the Paris Salon; athletes, laborers and working people were some of his preferred subjects.[6] However, in 1914, he exhibited a major work in marble, *Tres in Una*, which is unique within his oeuvre.[7] Using the motif of the three graces, Richer depicts the ideal of feminine beauty in the Classical period, the Renaissance, and his present day. He worked on this piece for at least ten years; there is a plaster

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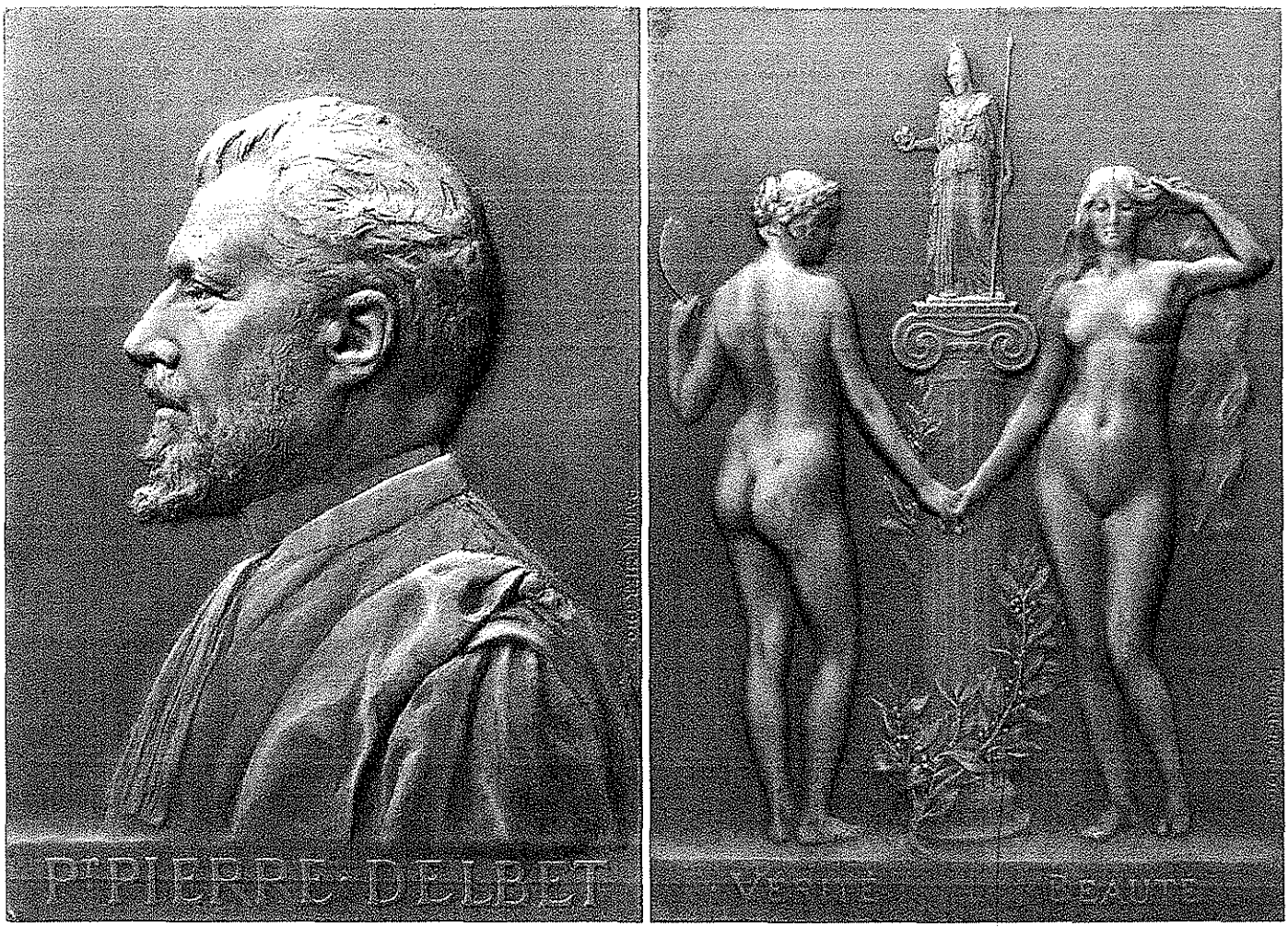
[3] Teive HA, Chien HF, Munhoz RP, Barbosa ER (December 2008). "Charcot's contribution to the study of Tourette's syndrome," *Arq Neuropsiquiatria* 66 (4): 918-21

[4] Director of the Laboratory of Maladies of the Nervous System

[5] *Anatomie Artistique* (1890), *L'Anatomie dans l'art* (1893), *Physiologie artistique de l'homme en mouvement* (1895)

[6] Le Salon: 1888 and Le Salon: 1892

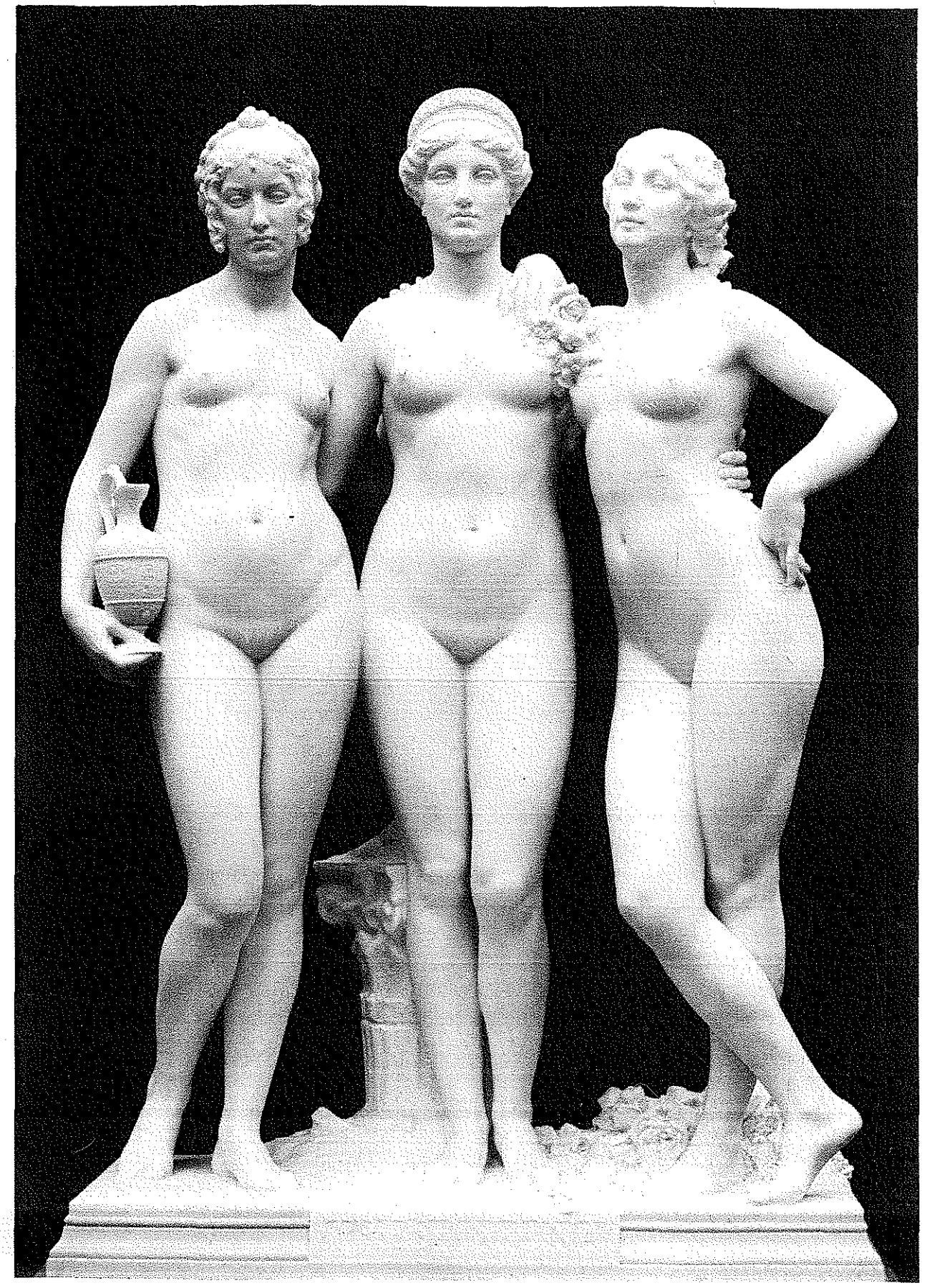
[7] Tres in Una is described in detail in Dr. Meige's Appendix I

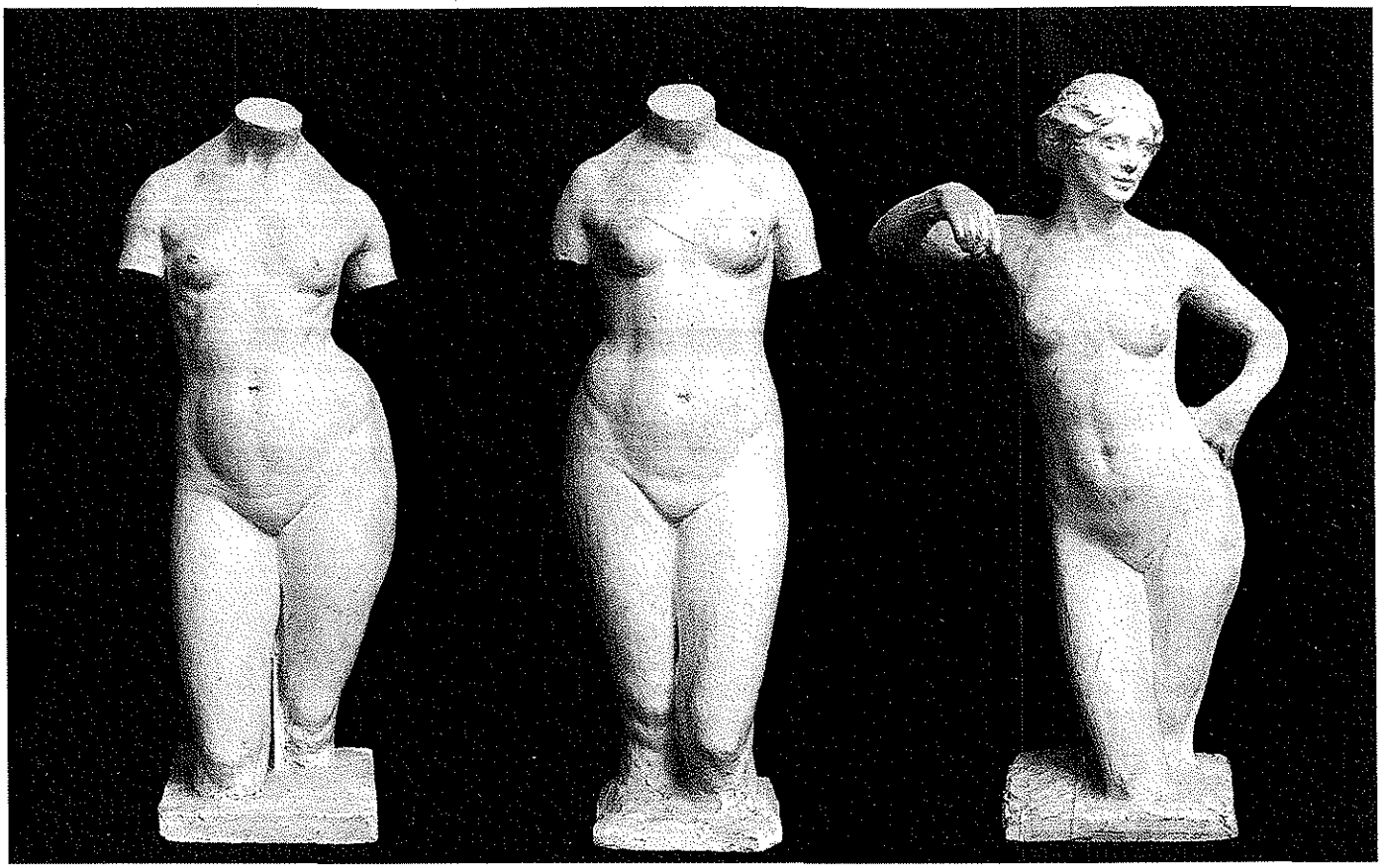


iii. P. Richer, bronze medal for Dr. Delbet, 1910. recto (left), verso (right). 70x90mm. Collection of Atelier de Brésoles

maquette for this composition dated before 1903 in the collection of the Musée d'Orsay, and photographs of more developed torso studies in the collection of the École (see pg. 12, 13), indicating that he had determined the elementary features of the composition at an early stage of development. During the same period, he completed the bronze medal for Dr. Delbet (1910), with figures on the verso resembling his Classical and modern women. The research he undertook to create *Tres in Una* certainly informed this text, which was published six years after the completion of the marble sculpture. Thus, Richer was actively engaged with the complex subject of female morphology for nearly two decades before publishing this book.

Richer published more than twenty works, independently and in collaboration with his colleagues, on diverse subjects including human proportion, the nude in the history of art, maladies in works of art, epilepsy, hypnotism, and equine anatomy. After his *Anatomie Artistique*, he released another text on the male form in 1906, *Éléments d'Anatomie: L'Homme*, which was the first book in his six-volume series, *Nouvelle Anatomie Artistique du Corps Humain*. The second volume was *Morphologie: la Femme* (1920), followed by *Attitudes et Mouvements* (1921), and completed with three volumes on the treatment of the nude in the history of Egyptian, Greek, and Christian art. As his teacher Duval had before him, Richer's texts established the canon of artistic anatomy for the next generation of artists and art students.

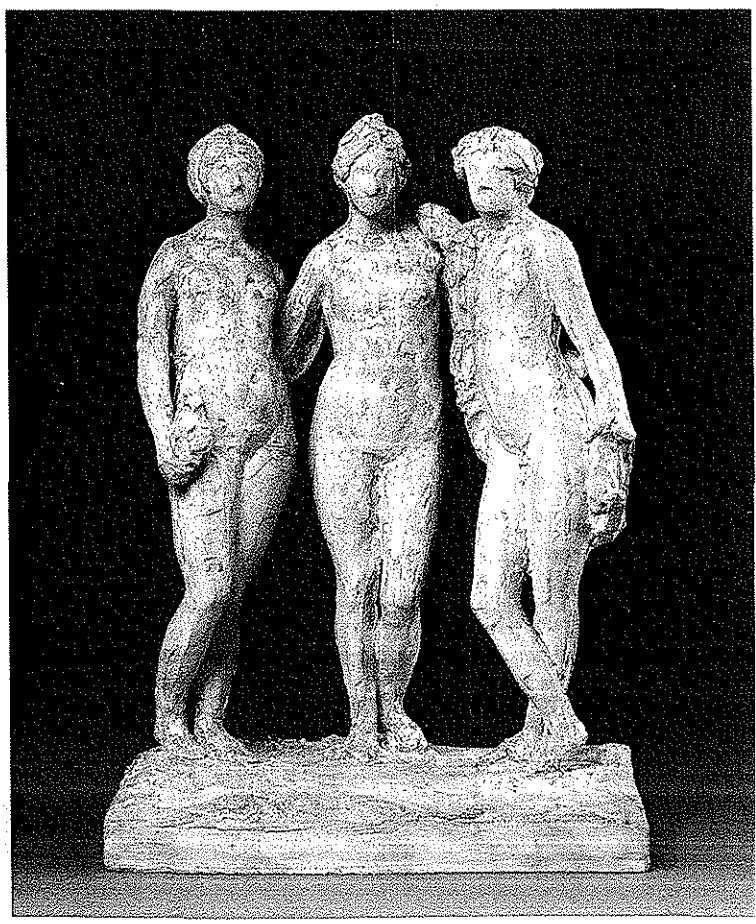


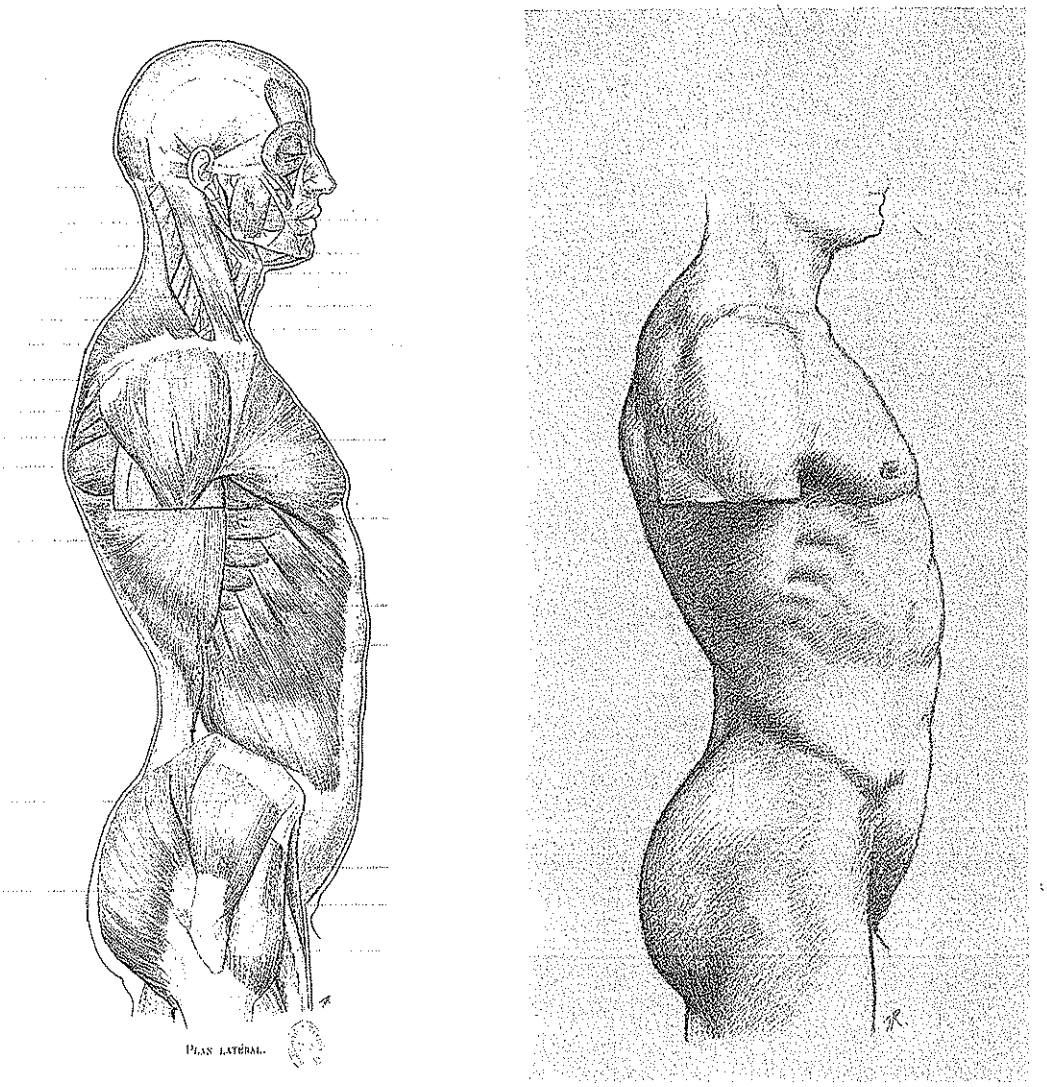


Left: iv. P. Richer, Tres in una, marble, 1914. Presently in the collection of the 8e arrondissement, Paris. Wikimedia Commons: {PD 1923}

Above: v. P. Richer, Plaster casts of three female torsos, dates unknown. École Nationale Supérieure des Beaux-Arts, Paris.

Right: vi. P. Richer, maquette for Tres in Una, plaster, before 1903. Musée d'Orsay, Paris.



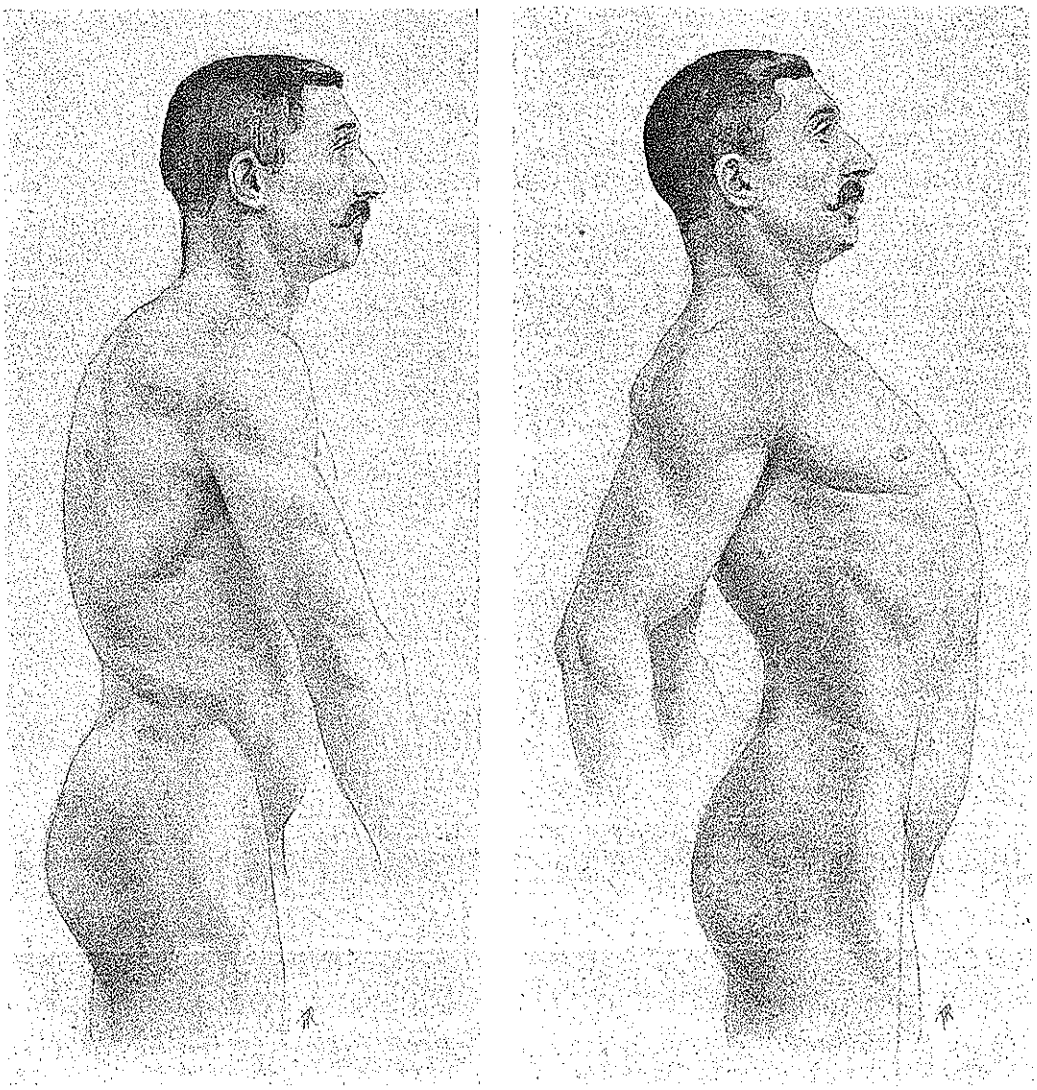


vii. P. Richer, Anatomie Artistique, 1890.Anatomy: Plate 55 (left), Morphology: Plate 79 (right). Reprinted with permission from the Bibliothèque nationale de France

Anatomy and Morphology in Richer's Major Works

Anatomie Artistique is a grand series of folio-sized plates in which the text is separate from the illustrations: an impressive anatomical atlas. In it, Richer examines the osteology, myology, superficial form, proportions, and movement of the male body. Richer made all of the illustrations for his texts, and his drawings for *Anatomie Artistique* were completed with the utmost accuracy: they are to scale for a figure that is exactly 172 cm tall.[8] His illustrations are supported by his own proportional canon, developed from his measurements of live subjects. In these illustrations, Richer creates a perfect image of a man from his skeletal structure through the layering of his muscles and his skin. His muscles express tone as the living figure would; his ribcage expresses the volume of breath rather than the flatness of the cadaver; his spine has a beautiful posture. He is posed in reference positions that minimize foreshortening while maximizing the visible area of the body. This figure is an exemplary manifestation of masculine form and approaches a classicized ideal, albeit a natural one. In his first great work on artistic anatomy Richer scarcely discusses anatomical differences between individuals; instead, he emphasizes the unifying aspect of anatomy.

[8] P. Richer, Hale trans. p. 137. Illustrations correspond to 1/3, 2/5, or 1/4 lifesize.



viii. P. Richer, Anatomie Artistique, 1890. Movements: plate 90. Reprinted with permission from the Bibliothèque nationale de France

After describing the anatomy of the male figure in the first section of *Anatomie Artistique*, he begins the section on morphology by stating:

> *"We arrive here at the culminating point of this work, and all that has preceded it has simply been preparation for what will follow. We will first examine each part of the body in an immobile pose chosen for study purposes. Next, I will mention the modifications that occur in the exterior forms of each area during specific movements."*[9]

While Richer expresses his conviction about the importance of morphological study, his treatment of the subject in *Anatomie Artistique* is rather limited in scope because he confines this study to one male body type. Although this analysis does provide a sound base for an aspiring artist to build upon, it also leaves aside some of the fundamental questions confronted by the figurative artist: how are individuals alike, and how do they differ? And what of the female form, which follows different laws and demands its own explanation? Nearly thirty years passed before he took up the topic again in this, his only text on morphology. In the interval, he redesigned the anatomical program at the École to emphasize morphology and *living anatomy,* by his own definition, at the highest level.

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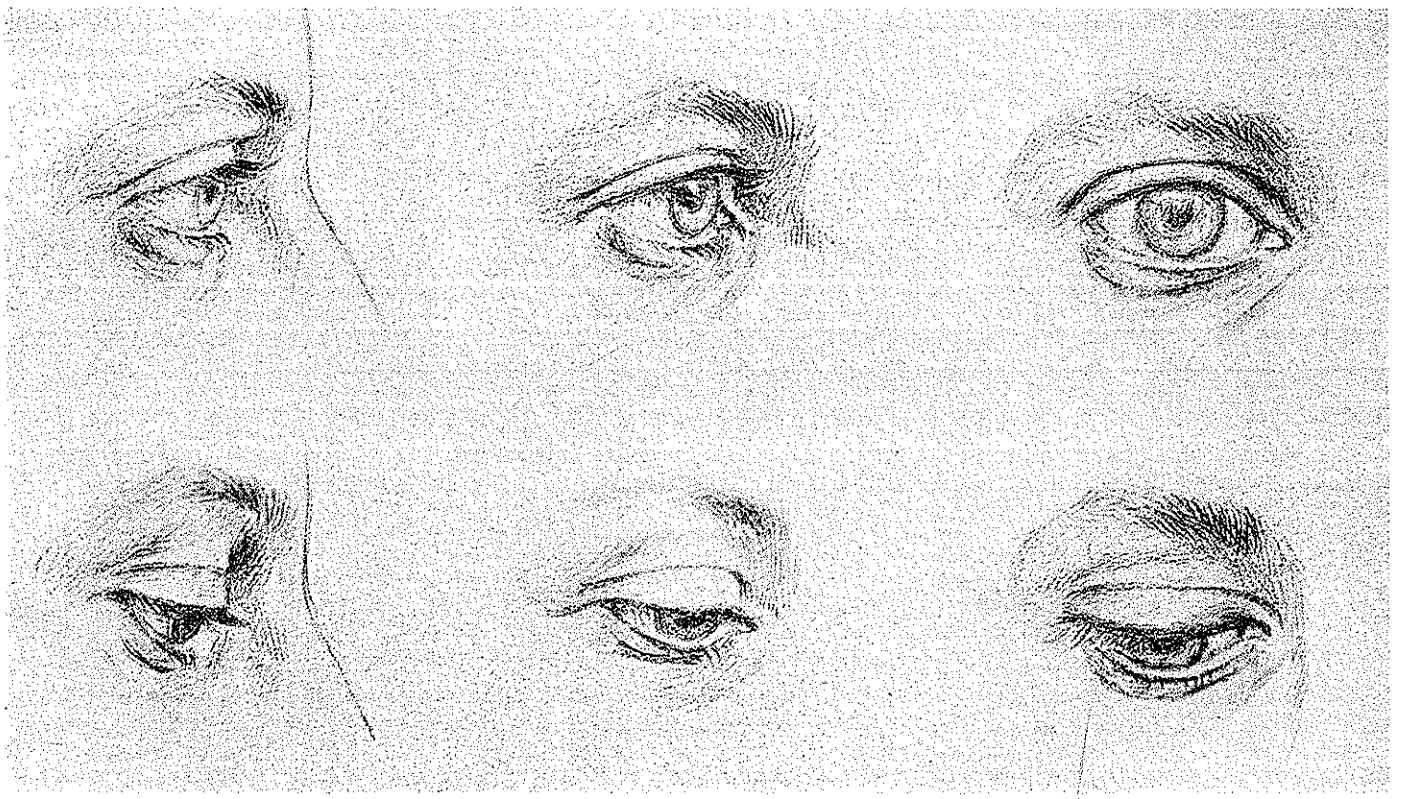
[9] P. Richer, *Anatomie Artistique*, 1890. Paris: E. Plon Nourrit, p.151: Benham, translation.

If *Anatomie Artistique* is an atlas, then *Nouvelle Anatomie Artistique* is an encyclopedia of the human form. It is reformatted into a much smaller octavo size, making it at once more portable and less formal. The first volume, *Éléments d'Anatomie: l'Homme*, is largely adapted from *Anatomie Artistique*, with a new series of drawings that illustrate the relationship between the anatomical structure and the exterior form and emphasize morphology to a greater extent than in the earlier text. However, Richer made a deliberate choice to follow a different model for *Morphologie: la Femme*. He did not select one feminine type and represent her from reference position with meticulous diagrams. Instead, he takes the external form as a starting point and examines how it differs between different women, then investigates the causes of those differences within the structure of the body. He coins specific terms to describe the most pronounced physical qualities; for example, the hourglass figure vs. the straight figure; the abdominal type vs. the thoracic type, etc. At the same time, he emphasizes the idea that nature presents a continuum of form rather than a set of either/or choices. This is a novel approach which recognizes the inherent physical differences between all people and the artistic value of this diversity. With this text, Richer breaks the classical mold of the idealized figure and embraces the richness of nature.

In fact, Richer plainly states that the sort of analysis he conducted of the male form would be redundant if applied to the female form. There is no need for him to discuss the fundamental bone and muscle structures in this book since they hardly change with gender and were thoroughly described in his previous work. He does assume, however, that the reader is familiar with male anatomy to provide a basis for comparison with the female form. Richer declares that this text represents a comprehensive work on the human body in general, as it discusses both male and female forms. In his introduction to this text Richer states:

> *"The man and the woman are built on the same model. They are derived from a single type. To describe the forms of the woman is to indicate precisely how they differ from those of the man. The anatomy is the same for both. And morphology varies not only with gender but also with each individual. These variations have virtually no limits and constitute the physical individuality of each person."*

It is significant that Richer frames this work as a study in morphology rather than anatomy. For the male figure, he primarily took an anatomical approach. In one sense, the anatomy, the actual bone and muscle structure, reads through the surface of the body more directly in men, while it is concealed to a greater degree in women by superficial fatty and cutaneous forms. Anatomy is an exact science, with identifiable, named structures occurring in the same places in different individuals. It provides a unifying basis for the discussion of the body and is the logical starting point for anyone learning about the construction of the human form. Morphology, in contrast, focuses on individuals. It implies that one begins with the complete form and works backward to understand the relationships between its component parts. Morphology encompasses skeletal and muscular anatomy as well as the skin and fat that clothes the muscles, and considers the manner in which all of these elements are arranged within the body. It seeks to define the particular rather than the general, and is of great importance to artists who are interested to learn why each individual is unique despite the similar anatomy that we all share. While one could certainly speak of anatomy or morphology relative to any individual, Richer's emphasis on morphology underscores the aspects of the female body that differentiate it from the male: principally, the role of fat and soft tissue in creating the superficial form. His analysis reinforces to the artist that direct observation, supported by knowledge, is all that is necessary to understand the human body. The role of dissection and anatomical study, while important, is not more valuable than the process of observing the complete form. Thus, the living body itself is the source of enlightenment, which artists may achieve through their working process.



ix. P. Richer, detail from Nouvelle Anatomie Artistique, Morphologie: la Femme, Figure 30: Eyes open and half-closed, in two views.

As the approach of this text differs from *Anatomie Artistique*, so do the drawings used to illustrate it. Here, we see two types of drawing: *diagrams*, line drawings that are simplified to plainly express a certain idea, and *sketches*, made from live models in which the physical character of the model, accurately portrayed, is the *raison d'être* for the work (see Figure ix, above). While the diagrams are similar to those presented in *Anatomie Artistique*, the sketches give an entirely different sense of Richer's draughtsmanship. Richer shows us numerous views of different individuals, women and men, drawn from life with expediency. Rather than standing in reference poses, many of these models stand naturally. When they are posed, it is for the purposes of examining the effects of posture between different individuals, or the effects of movement by the same individual. There is a special attention to forms observed from the living model and the great degree of variety that may be seen when one is prepared to notice it.

While the drawings in this text are all very effective in communicating visual ideas about the forms of the human body, the sketches have a special significance. Readers who are familiar with Richer will enjoy discovering this side of his artistry and may be inspired to emulate his careful observation and confident draughtsmanship in their own studies from life. While Richer's diagrams from *Anatomie Artistique* were undoubtedly highly influential for generations of artists and artistic anatomists,[10] and have helped thousands of artists to understand the structure of the human body, their function is didactic. Such linear perfection would be very difficult to achieve for an artist working from life in the studio. But in this text, Richer teaches his reader not only about the forms of the figure, but also how one may capture gesture and character through astute observation and the art of drawing. Richer's sketches are at once clear, precise, and fluid. They represent the figure with the most elegant means: a style born of understanding.

[10] See Peck, Bammes, Hale, Goldfinger, etc.

Research, Investigation, and Comparison

The École began making photographic references available for students in 1864.[11] Richer embraced photography and made extensive use of it in both his clinical and artistic research. He collaborated for many years with photographer Albert Londe (1858-1917), and was interested in using the medium to make a visual record of the human form. Richer took many plates comparing different models in the same pose (see Figures x and xi, right). Richer and Londe built elaborate cameras to take time-lapse images of the body in movement, effectively comparing one body to itself during the passage of time. Richer also photographed psychotic episodes in some of his patients. When he began as Chair of Artistic Anatomy at the École, Richer requested that an electric projector and large screen be installed in his classroom. On occasion, Richer traced over photographs to create diagrams for his texts.[12] His superior knowledge of anatomy allowed him to interpret the photograph and select the qualities he desired from it: motion, action, or structure. Photographs gave him copious reference material for his studies on morphology and freed him from reliance on human dissection for his anatomical research.

As the basis for his research on proportion and morphology, Richer used an anthropological method to collect data from a pool of live male and female subjects. He formulated a data sheet to record basic information about the individual (height, age, weight, name, etc.), and thirty-six measurements from the body.[13] Richer describes the instruments he used so that one could replicate his procedure today.[14] He made the same series of measurements on each person and took photographs of them in a variety of poses. These photos were compiled into albums to help him find points of similarity and difference between individuals. He analyzed this data to describe the proportions of an average male and an average female physique, and then examined individual variations from these averages. His study of proportion is profound. In considering female proportions, he chose to define the female body relative to not one, but three body types: a petite form, an average figure, and a larger figure. With this choice, Richer acknowledges a multiplicity of natural, normal forms of the female body. He also scales the proportions of each body type to a size of 100 units which permits him to compare proportions between people of different heights. By establishing the proportions of an average figure and then examining individual variations from that average, his analysis gives artists all the information that is required for a thorough grasp of the subject.

In looking at Richer's photographs of his models, we realize the need for a new vocabulary to describe the nuances of form that we observe from one person to another. The process of comparison is extremely enlightening, yet without words to describe the variations of the body, we lack the ability to fix the distinguishing qualities in our memory. This text is invaluable for defining terms to describe various configurations of the body so that the artist may identify and acknowledge them. For example, an open vs. closed pelvis, a sacrum placed high or low, a straight pelvis vs. an inclined pelvis, the presence or absence of specific fat deposits, etc. By assigning names to these different qualities, Richer empowers artists to remember the physical character of their models and to depict them with precision and confidence. And while he certainly expresses aesthetic preferences, Richer does not use his research to define an ideal form for the female body. Instead, he uses the science of observation to categorize physical traits through a process of comparison.

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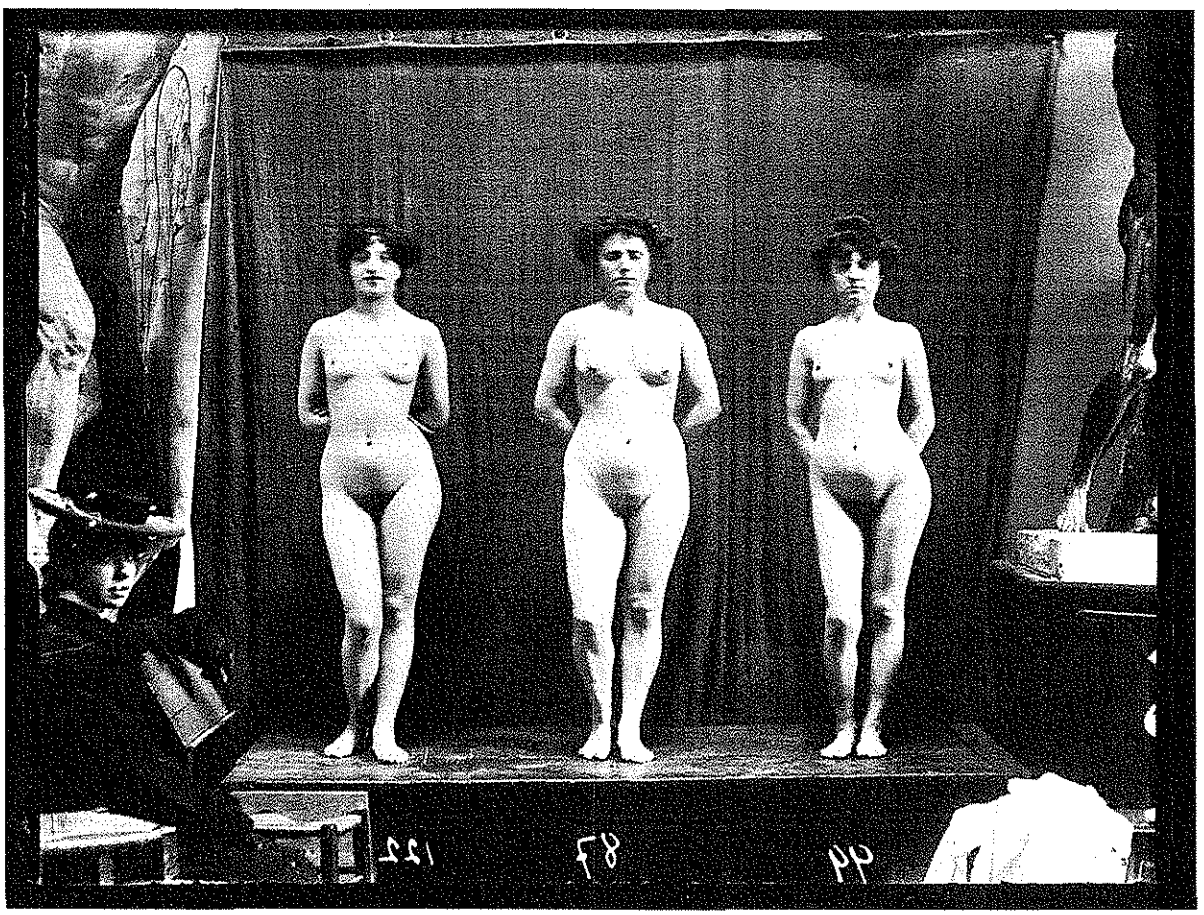
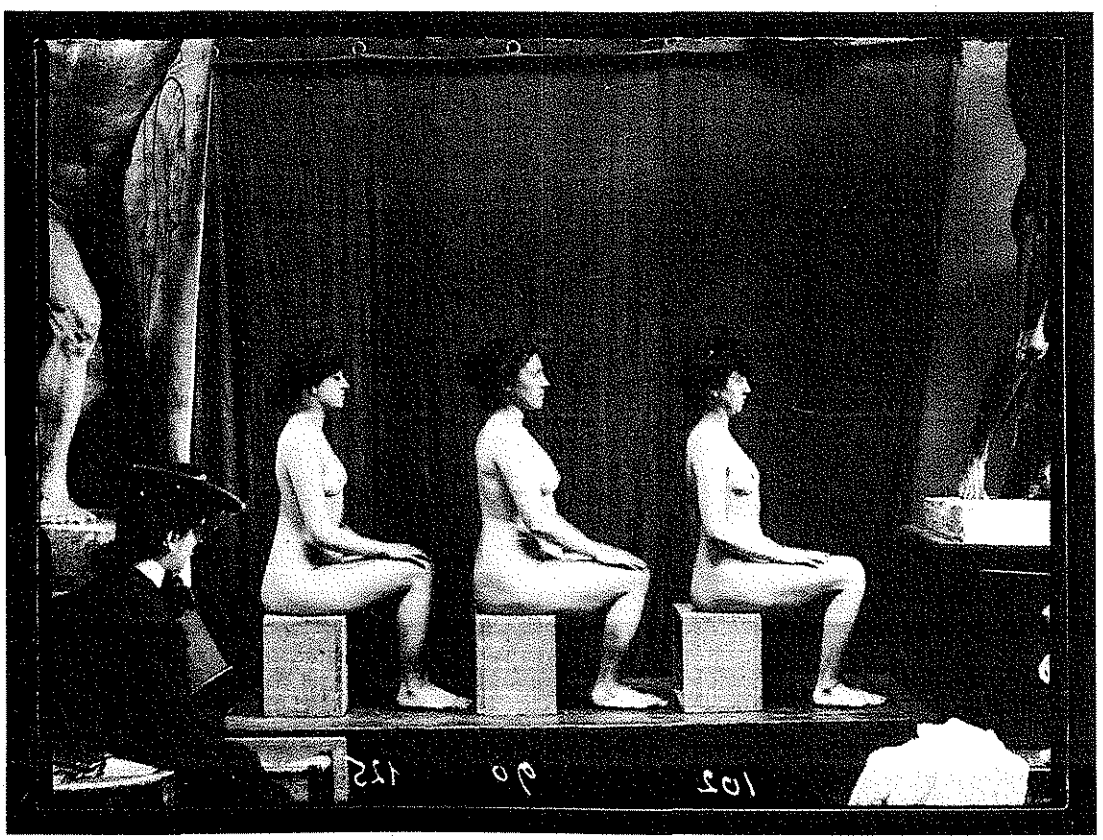
[11] Comar, *Figures du Corps*, Beaux-arts de Paris, 2008, p. 111

[12] See École Nationale Supérieure des Beaux-Arts, Paris: Ph 11574

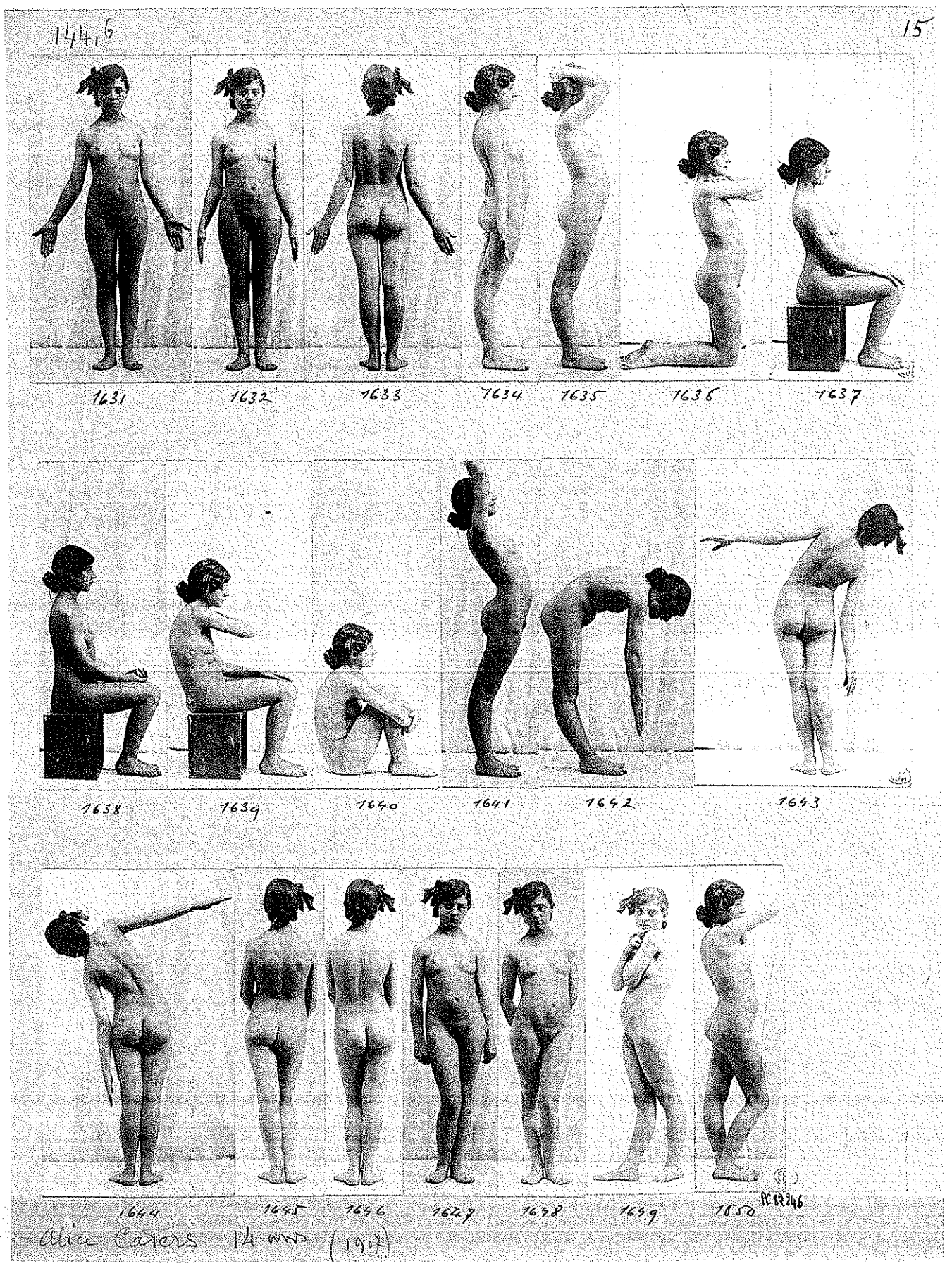
[13] See École Nationale Supérieure des Beaux-Arts, Paris: *Fiches anthropométriques*, Ms 838

[14] While Richer placed these descriptions in the body of the text, I have chosen to compile them in Appendix II. Many of his original instruments are now in the collection of the École Nationale Supérieure des Beaux-Arts, Paris.

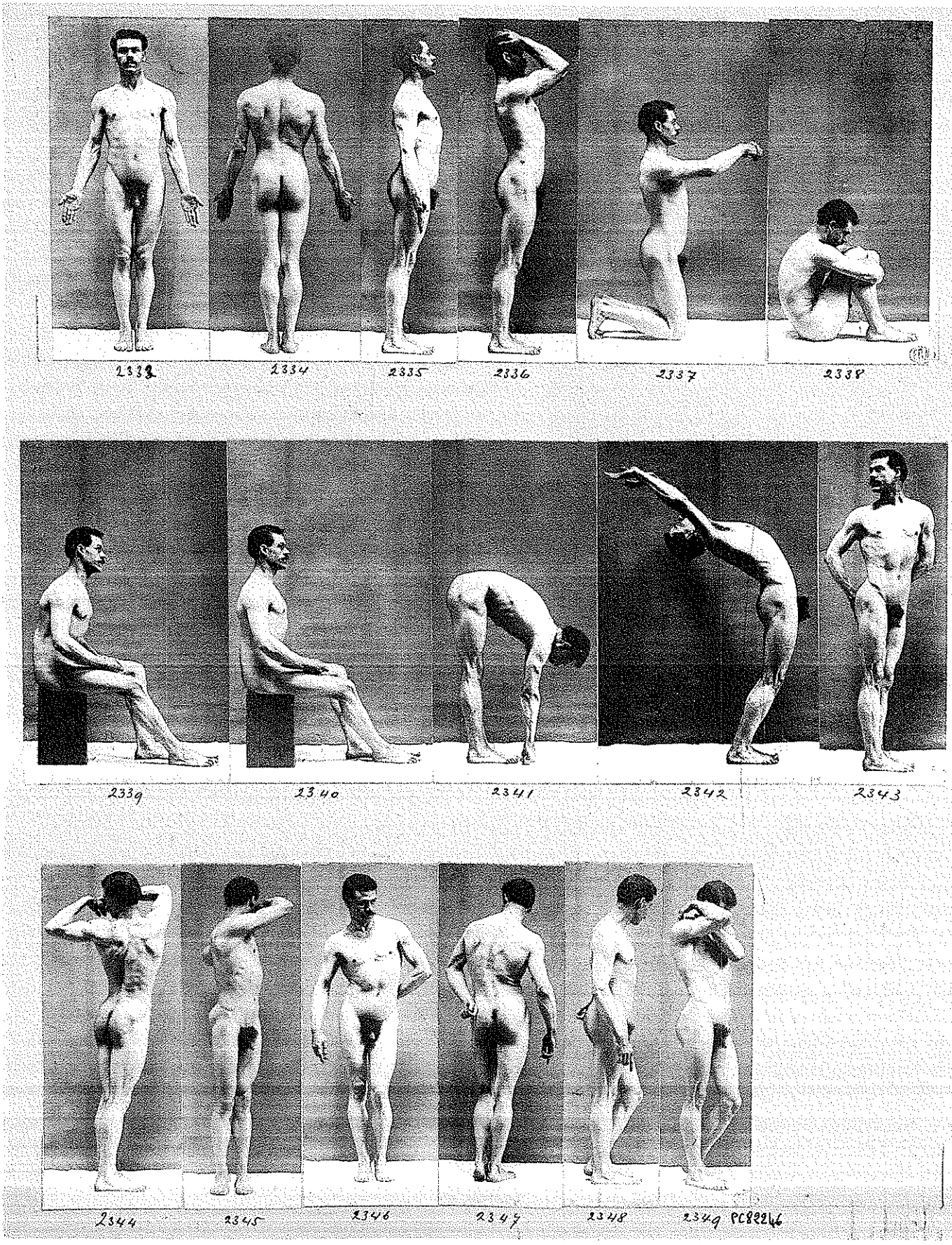




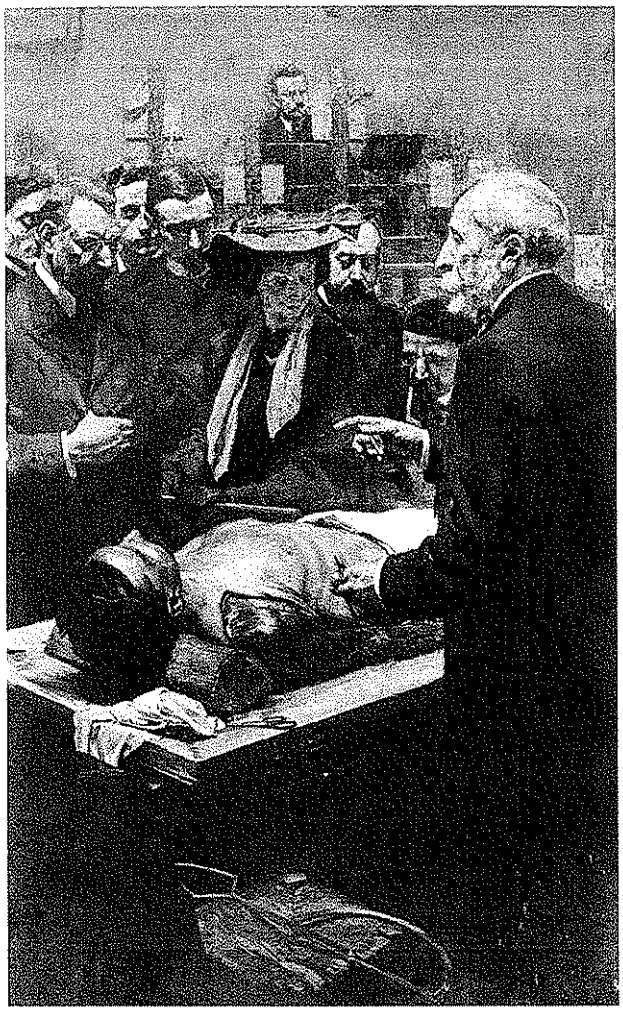
Above: x. P. Richer, Three female models standing, seen from the front. Photographic print, ÉNSBA Paris.
Below: xi. P. Richer, Three female models seated, seen in profile. Photographic print, ÉNSBA Paris.



xii. P. Richer, Nude female model Alice Caters, photographic print, 1907. ÉNSBA, Paris.



xiii. Paul Richer, Nude male model, photographic print, date unknown. ÉNSBA, Paris.



xiv. *G. Leroux, Les études de la peinture, silver print of a painting of Richer in the anatomical theatre, 1904.*

Richer's Legacy

Throughout the 19th century, students at the École des Beaux-Arts gathered in the anatomical theatre to study the cadaver. Human dissection had always been a cornerstone of the rigorous anatomical program at the École. Yet Richer, for all of his accomplishments as a physician, considered human dissection to be of secondary importance for the artist and delegated responsibility for dissection lectures to his assistant, Georges Chicotót (1855-1921). Many students at the École also found cadaver study to be disagreeable and did not attend dissections since they had access to many other resources for learning anatomy: photographic references, x-ray images, studies from life, references to classical masterworks, etc. In 1908, when Chicotot was lured away from the École by a job as the Director of Radiology at the hospital at Broca, Richer made the decision to break with two centuries of tradition when he terminated the practice of study from the cadaver.[15] He replaced it with a course on human morphology, allowing students to study the complete, healthy body in all of its variations. This text was derived from that new course, which revolutionized anatomical training at the École. It may seem incongruous that Richer, who would have spent numerous hours in the cadaver laboratory as a medical student himself, would end this practice for art students. Yet, Richer's teaching methods pushed students to take on the difficult task of capturing the qualities of a living being. At all costs, he wished his students to avoid making flat and dreary figures as a consequence of adhering too rigidly to a preconceived anatomical framework. With his decision, he anticipated the divergence between medical study and artistic training and recognized that they could never again be one and the same.

In the École des Beaux-Arts of the late 19th century, students made precise renderings of models in long poses with a preference for a strong visual effect and accurate form. Drawing from the live model was the foundation of the École curriculum through the early 20th century.[16] When a student was permitted to enter the École and take up drawing from the live model, he had arrived at the culmination of many years of artistic training from casts and prints. This type of sustained study requires a sharp eye and a practiced hand, and was supported by a rigorous instruction in artistic anatomy. Richer's texts come from this tradition of careful observation and were extremely influential in his lifetime for their accuracy and depth, for the clarity and beauty of their illustrations, and above all for the valuable preparation they gave to students as they approached the complexity of the live model.

Since the 19th century, the study of the nude has endured as a foundation discipline for art students, although the purpose and direction of this study has changed with each generation. Through the 20th century, life drawing was often employed as a means of approaching gesture drawing through short poses. This emphasis on movement was valuable for both commercial and fine art students: illustrators developed facility to quickly represent a convincing

[15] Comar, *Figures du Corps*, Beaux-arts de Paris, 2008, p. 478
[16] *ibid.* p. 16

figure, and fine artists forged a modern visual language by abstracting the body to its simplest components. Over the past century, the field of artistic anatomy was advanced by George Bridgman, Robert Beverly Hale, Gottfried Bammes, and Eliot Goldfinger, among others. Each of these anatomists has been influential for entire generations of students, and each has acknowledged the important work of Richer. In the latter part of the 20th century, artists began to return to the figure for more accurate drawings, rendered over a period of hours rather than minutes. Ateliers proliferated around the world, offering students a traditional art education modeled on European academies of the 19th century. With this return to sustained observation has come a renewed interest in historical teaching methods and artistic anatomy. Now, a new generation of artists is expanding the frontier using digital technology to create realistic 3-D human figures for video games and film. It is fitting that Richer's major work on the female form returns to a place of prominence in the 21st century as many artists are poised and eager to learn from the wisdom contained in its pages.

While Richer was innovative in his approach to his discipline, he was also a product of the social attitudes of his time. Unfortunately, his original text contains language that expresses a clear Eurocentric bias; parts of it seem blatantly racist to the modern reader. Richer uses terms that I find offensive such as references to 'inferior races.' I have tried to moderate his language while preserving the content of his ideas, though this has proven to be the most difficult aspect of this project. This marks but a small part of an otherwise stellar work, so I felt it necessary to follow my own moral compass in this regard and filter his text rather than presenting all of his words literally. I hope that this aspect of his writing will not linger in this translation, nor prevent anyone from appreciating Richer's scholarship. Also, I hope readers will not assume that I share or advocate any such beliefs and will understand them as a lamentable relic of generations past that should not be carried forward. It should also be noted that Richer's text is largely based on Caucasian women. While the basic morphological comparisons Richer establishes: open vs. closed pelvis, inclined vs. straight pelvis, etc., can be identified in people of all races, I believe his study would benefit from including people of all ethnic backgrounds. If I were to make any substantial alteration to this work, I would expand it to better represent humanity as a whole.

Richer also makes numerous mentions of the detrimental effects of wearing a corset to the woman's body. Because these observations are less relevant to our society than they were to his, I have placed his discussions on this subject in Appendix III rather than in the body of the text.

Finally, I have tried to make my translation read naturally in English while retaining the beautiful descriptive quality of Richer's French. Readers who compare my translation to the original text will find some modification of word order and more concise sentences in my version, though I have endeavored to confine my alterations to matters of style. I have been fortunate to have Hale's translation as a reference, and have maintained most, though not all, of his choices of anatomical vocabulary. I would certainly echo Richer's advice and recommend that any reader of this text give a close reading to Hale's translation of Richer's Artistic Anatomy; together these two works will give a more profound understanding of the human body than either text does alone.

As an artist myself, I am indebted to the school of artistic anatomy that laid the groundwork for Richer to develop his teaching methods and to the artists that have carried this tradition of teaching into our century. The human body will always be a vessel of mysteries, but thanks to the diligent research and marvelous drawings of Dr. Richer, we see that it is possible to comprehend its structure with the aim of expressing its spirit. Then, through a rigorous application to the practice of drawing, we may focus our attention on the gestures and emotions that reveal the spark of life. This text was written near the end of a lifetime filled with insightful research, and Richer has given artists a great gift with his perceptive description of the female figure. I am proud to bring this book to an English audience, and I am full of anticipation to see what artists will do with this knowledge.

- Allana M. Benham, 2015

FOREWORD

This little book is a fragment of my course at the École des Beaux-Arts in which, alongside the practical lessons dedicated to elementary anatomy that were published in my first volume,[17] I treat the external form, the artistic physiology of postures and movements,[18] and the artistic interpretation of the nude in various epochs of art.

One could call this part of my advanced course in which I extract current notions of morphology, most particularly those that are relevant to the female figure. To those who ask why I do not give an equal place to the masculine forms in this text, I respond that they have already been treated with all desirable depth in an important first work on artistic anatomy[19] published thirty years previously. Despite the time that has passed, I have nothing essential to add to that work. But, in that work, the feminine form was only approached secondarily or in passing. I think therefore that the time has come to fill this gap and dedicate a special volume to the feminine form. Since the best means of describing feminine forms is to compare them with masculine ones, masculine forms are far from being absent in the present work. Thus, this text offers an essentially complete work on human forms in general.

There is also mention of the child's forms in this work, but unfortunately in a rather concise manner because of the richness of our principal subject and the limits in which I must constrain myself.

To compose the illustrations for this little volume, I have gone through my sketches, which, since my entry into the École des Beaux-Arts, have accumulated from day to day, noting some details of curious or simply interesting conformations. These drawings, executed more or less hastily, generally take the form of sketches, made sometimes in Conté crayon, sometimes in lead pencil. Some have been done on tinted paper with *deux crayons*.

I have not thought it necessary to remake the sketches in order to compose them into more homogenous ensembles. It seemed to me, on the contrary, that by their character, as notes taken from nature without preconceived ideas, they have an accent of truth which photographs themselves do not always have.

So, I have merely chosen the sketches that appear to me to be the most demonstrative and composed them in a manner that groups together the plates that refer to the same subjects. It is thus we find drawings of related subjects that are highly variable in intensity, and sometimes very different in their creation.

Those who think they will find models of perfection and beauty here will find themselves greatly mistaken. This has not been my goal. This work is exclusively scientific. Far from seeking the realization of any artistic ideal, which is always highly variable with the times and with individuals, this work tries to simply show to artists that which is, and the reasons for that which is. Without wanting to define what is currently called the 'beautiful' and the 'ugly,' whose limits have never been neatly fixed, it contents itself to develop, as much as possible, the conditions of the normal state. To achieve this, I have primarily engaged myself with defining the irregularities of form so that students will learn not to reproduce such irregularities unless they are found in the model. But I have not forgotten that the free play of organs and the totality of their actions, which constitute the state of health, are compatible with varied forms, among which the artist's choice must be freely exercised.

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[17] *Nouvelle anatomie artistique, vol. I. Cours pratique. Elemens d'anatomie: l'homme*. Paris, Plon-Nourrit et Cie, editeur, 1906.

[18] These questions of physiology have already been the subject of a text; *Physiologie artistique de l'homme en mouvement*. 350 pages, with 123 illustrations in the text and 6 photoprinted plates. Doin, publisher, 1895

[19] *Anatomie Artistique. Description des formes exterieures du corps humain au repos et dans les principaux mouvements*. Translated and edited by Robert Beverley Hale: *Artistic Anatomy*, Watson-Guptill Press, 1971.

Therefore, this work does not resemble in any fashion those done in earlier times which attempted to define the 'beauties' of the woman, or which wanted to restrict the expression of the normal state of health into a singular form. My goal is more modest, and I mean to state it clearly from the beginning.

By delaying this publication, favorable circumstances could further enrich the multitude of research on which it is based. But there comes a time when one must plan for the harvest or risk seeing it lost in the field.

Moreover, it seems to some of my editors that this part of my course presents some new observations whose interest goes beyond the circle necessarily restricted to students. Therefore, today I offer artists the result of my observations, such as they are, following the poetic precept: *he who knows not, restricts himself.* It is not that I presume to teach anything new to those whose long experience has familiarized them with all the varieties of the human form. But perhaps they will find in this little treatise, condensed and formulated in a manner most exact, some knowledge that they have spent a long time in acquiring, and whose empiricism has always been left with a bit of imprecision. In teaching artists of the diverse forms that nature, inexhaustible and fertile, does not cease to offer, it should help them to better judge and understand the realities they find in their models.

The man and the woman are built on the same model. They are derived from a single type. To describe the forms of the woman is to indicate precisely how they differ from those of the man. The anatomy is the same for both. And morphology varies not only with gender but also with each individual. These variations have virtually no limits and constitute the physical individuality of each person.

From this point of view, one could establish a long series of intermediate types that transform imperceptibly from one into the next between the two extremities of the most different examples; on one side, the masculine type, and on the other, the most pure feminine type. It is in these intermediate types that the ancients have worked to create the interesting image of their hermaphrodite.[20]

The morphological characters of the man and the woman are the consequence of differences in the volume and proportion of the same anatomical elements, and also sometimes in their manner of arrangement as well as their degree of finesse.

We will distinguish three sorts of morphological elements in women: the character of the bones, the fat, and the skin. We will describe them in the first part of this text. In the second part, we approach the morphology of each of the principal regions of the body.

- Dr. Paul Richer, 1920

[20] The hermaphrodite, such as it was conceived and represented in ancient art, is not a case of teratology. The malformation of the sexual organs has nothing to do with it. It is a mixture, a sort of amalgamation, of the external forms of men and women. A conception such as this demands a profound science of forms in order to be executed. The hermaphrodite at the Altes Museum in Berlin is the most striking realization of this type.

I. SKELETAL CHARACTERISTICS

I will present the characteristics of the skeleton in two distinct chapters. We will first discuss proportions, which are always under the influence of the length and volume of the bones, and second, the particular conformation of certain parts of the skeleton according to gender.

A. PROPORTIONS

It is important to establish the average proportions of the individual right away. This average canon, based exclusively on scientific findings, is simply an abstraction. It nonetheless constitutes a general rule that governs the relationships between different parts of the body. It is like a center, from which individuals evolve in one direction or another. It does not exactly represent any individual, yet it unites all figures at once. It also permits comparison between proportions of men and those of women.

1. Male Proportions

The average canon of male proportions was stated many years ago by Dr. Topinard,[21] and is based on numerous measurements taken by anthropologists. I have merely given a form to this canon, which is comprised solely of numbers, and applied it to an artistic method that takes one part of the body as a unit of measure, or module. I have chosen to use the height of the head in this manner. This makes the canon more demonstrative and easier to understand and apply.[22] This scientific canon, based on absolute measurements, is divisible with great precision following the method of artists. And it is a remarkable example of the excellence of the artist's observation that his glance and intuition have preceded the patient research of scholars.

The average canon of the adult European male can begin thusly: the length of the head, which serves as the common measure, is inserted 7½ times into the height of the body. The head itself is divided into two equal parts by a horizontal line passing through the inside corners of the eyes.

The torso, which includes the head, measures 4 head lengths. Its subdivisions correspond to reference points situated on the anterior and posterior sides of the torso. The first subdivision, tangent to the chin in front, cuts the back of the neck a bit above the 7th cervical vertebra. The second corresponds to the nipples in front, and in back, to the thoracic region, a bit above the bottom corner of the scapula. In front, the third subdivision is situated in the vicinity of the navel, and in back, it touches the superior limit of the buttock. Finally, the fourth division passes through the bottom of the genitals in front and merges with the gluteal fold in back. Of all these reference points, the last is the most important because it is fixed most precisely.

On the anterior part of the torso, we observe other reference points that are equally fixed because they belong to the skeleton. Thus, the anterior superior iliac spine is situated ¼ head below the third division, which passes through the navel, or ¾ head above the inferior limit of the torso. From the anterior superior iliac spine, one measures 2 heads in a vertical direction to the clavicle, and also 2 heads to the suprasternal notch in an oblique direction. It follows that the clavicle is located ¼ head below the chin and that the suprasternal notch is a bit lower, approximately ⅓ head below the chin, which corresponds to the length of the neck from the front.

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[21] *Élements d'anthropologie générale*. Paris: A. Delahaye et É. Lecrosnier, 1885

[22] *Canon des proportions du corps humain*. Paris, Ch. Delagrave, 1893

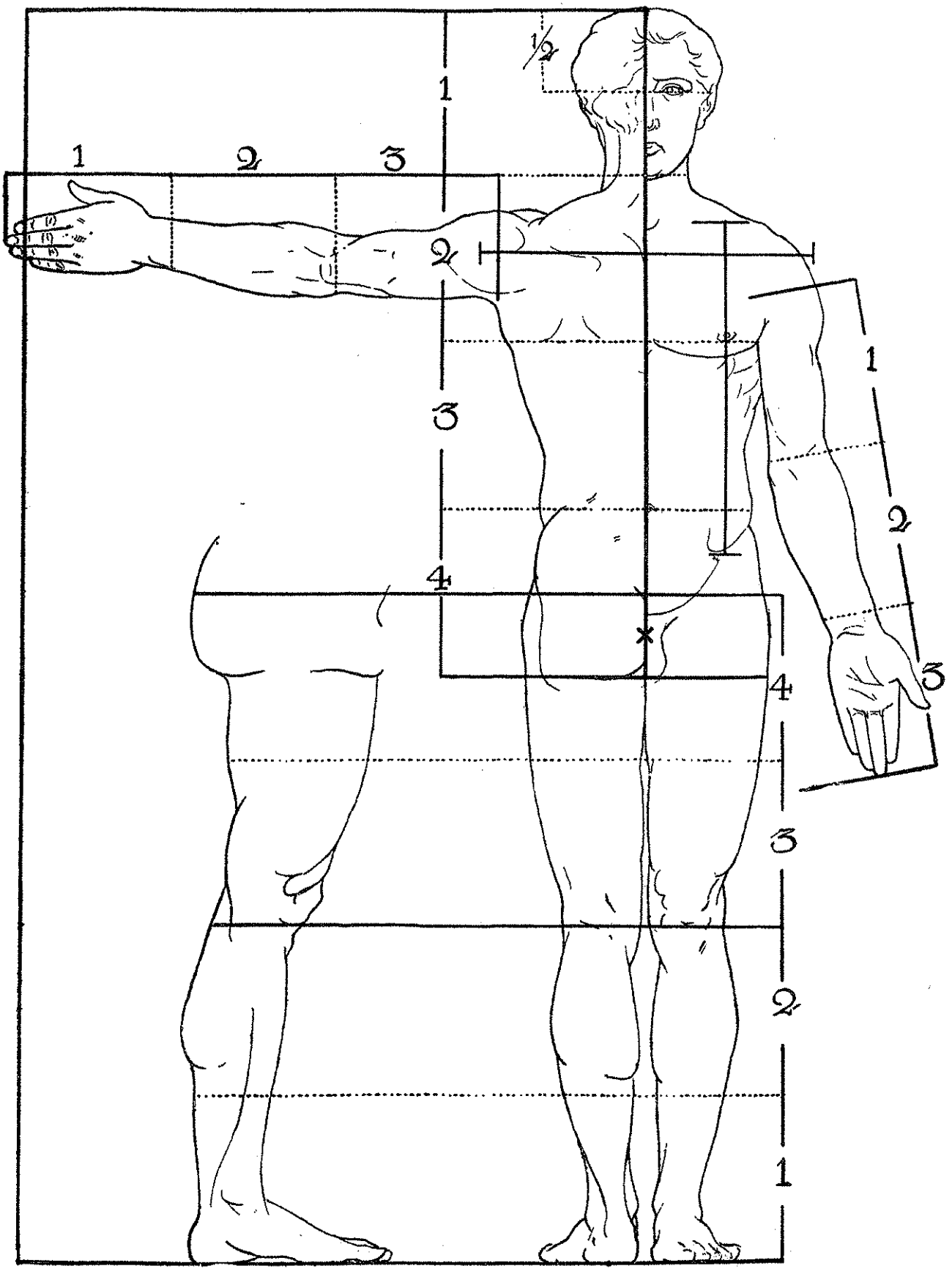

Figure 1: Average male proportions

Like the torso, the leg measures 4 heads, from the sole of the foot to the middle of the crease of the groin, which corresponds in depth to the joint of the hip. But these two lengths, the torso and the leg, overlap one another by just half a head. It therefore results that the figure in totality has only 7½ heads in height, and its middle corresponds to the center of this overlapped part, that is to say, halfway between the inferior limit of the torso and the superior limit of the leg, at which point one finds the root of the genitals.

The lower limb is divided thusly: from the sole of the foot to the articular plane of the knee measures 2 heads; from this last point to a fingers' width above the great trochanter, at the middle of the crease of the groin from the front view, 2 heads equally. Seen from its medial and posterior sides, the height of the lower limb measures 3½ heads from the sole of the foot to the gluteal fold, and a small distance more from the perineum.

The following equalities are noted on the lower limb: from the anterior superior iliac spine to the center of the patella, the distance is the same as from the center of the patella to the sole of the foot. This distance can be taken in a slightly different manner by putting the entire patella into each of the halves; for example, from the sole to the top of the patella, and from the bottom of the patella to the iliac spine. This new measurement can also be applied to the torso: from the suprasternal notch to the top of the pubis.

The upper limb measures more than 3 heads, and not infrequently 3½ heads in total, from the top of the acromion process to the end of the middle finger.[23] In the upper limb, we find the following equalities already observed by Leonardo da Vinci and often recalled in artists' studios: from the summit of the acromion to the olecranon, the distance is the same as from the olecranon to the distal end of the third metacarpal; each of these lengths measures 1½ heads. The top of the olecranon can be replaced as a reference point by the cubital fossa, which lies above the radiohumeral joint. The forearm, or the distance from the top of the olecranon to the distal extremity of the middle finger, measures 2 heads.

The principal measures of the width of the torso are as follows:

- The maximum width of the shoulders is just under 2 heads
- The diameter across the trochanters, or the maximum width across the hips, equals 1½ heads.

Figure 1 (left): Average male proportions

- *The head goes 7½ times into the height of the body. A horizontal line passing through the interior corners of the eyes divides the head into two equal parts.*
- *The torso measures 4 head lengths, from the vertex to the gluteal fold, at the crease of the buttocks.*
- *The lower limb also measures 4 head lengths, from the sole of the foot to the middle of the crease of the groin, which corresponds in depth to the articulation of the hip.*
- *The midpoint of the figure is located below the pubis, at the base of the genitals.*
- *The upper limb measures just under 3½ heads.*
- *The breadth of the figure with arms outstretched slightly exceeds the height from head to foot.*

One observes the following equalities in the limbs:

- *In the arm, the distance that extends from the top of the acromion to the distal end of the third metacarpal is divided in two equal parts by the top of the olecranon process, or the cubital fossa, situated at the same level.*
- *In the lower limb, the center of the patella divides the distance from the sole of the foot to the iliac spine into two equal parts.*

[23] For more details, see my *Canon des proportions du corps humain.* Paris: Delgrave, publisher, 1893

2. Female Proportions

In their canons, artists have generally given the same height proportions to women as to men. The subdivisions of the body are the same, as well as the reference points. They have merely stated that the differences result from the varying diameters of width across the torso. But, a work on the average scientific proportions of women has not been made, as it has for men, because of the insufficient number of measurements concerning women; anthropological research has always been conducted on male subjects.

I have tried to fill this gap as much as possible by measuring a large number of female subjects. I have not chosen them specially, or after any ideal. I measured them one by one as they presented themselves for my observation, and their sole point in common is to be professional models. They number one hundred women over the age of twenty, from which I have developed an average canon comparable to that of the male. All measurements were taken following the same method on each subject, facilitated by the use of data sheets printed in advance.

To permit comparison between men and women, I have applied my system of measurement to a sufficient number of male models in order to establish an average which, having been obtained by the same procedure, could be put alongside the average of the female models.

This average male was deduced by taking measurements from thirty subjects and, as one could expect, is almost identical to the average canon of the anthropologists described above. The sole measure that differs appreciably between the two is the width of the shoulders, larger on the average of my thirty models than on the anthropological canon. The reason for this difference exists perhaps because all of the subjects I measured were professional models, and several of them were remarkable athletes. With this reservation, it seems to me that the average canon accepted by anthropologists is close enough to the average obtained from the measurements of my thirty male subjects that I can use my average male in comparison with the average measures taken on a greater number of female subjects. The similarity of professions between male and female models makes the comparison even more legitimate.

Figure 2 (right): Average female proportions

- *The head goes 7½ times into the height of the body.*
- *The torso slightly exceeds 4 head lengths from the vertex to the gluteal fold, at the crease of the buttocks. The lower reference point goes a bit beyond the inferior limit of the 4th head length.*
- *The midpoint of the body is located at the upper edge of the symphysis pubis.*
- *The lower limb, from the sole of the foot to the acetabulum, doesn't quite reach 4 head lengths as a consequence of the greater length of the torso.*
- *The upper limb is less than 3½ heads.*
- *The breadth of the figure with arms outstretched is slightly less than the total height from head to foot.*

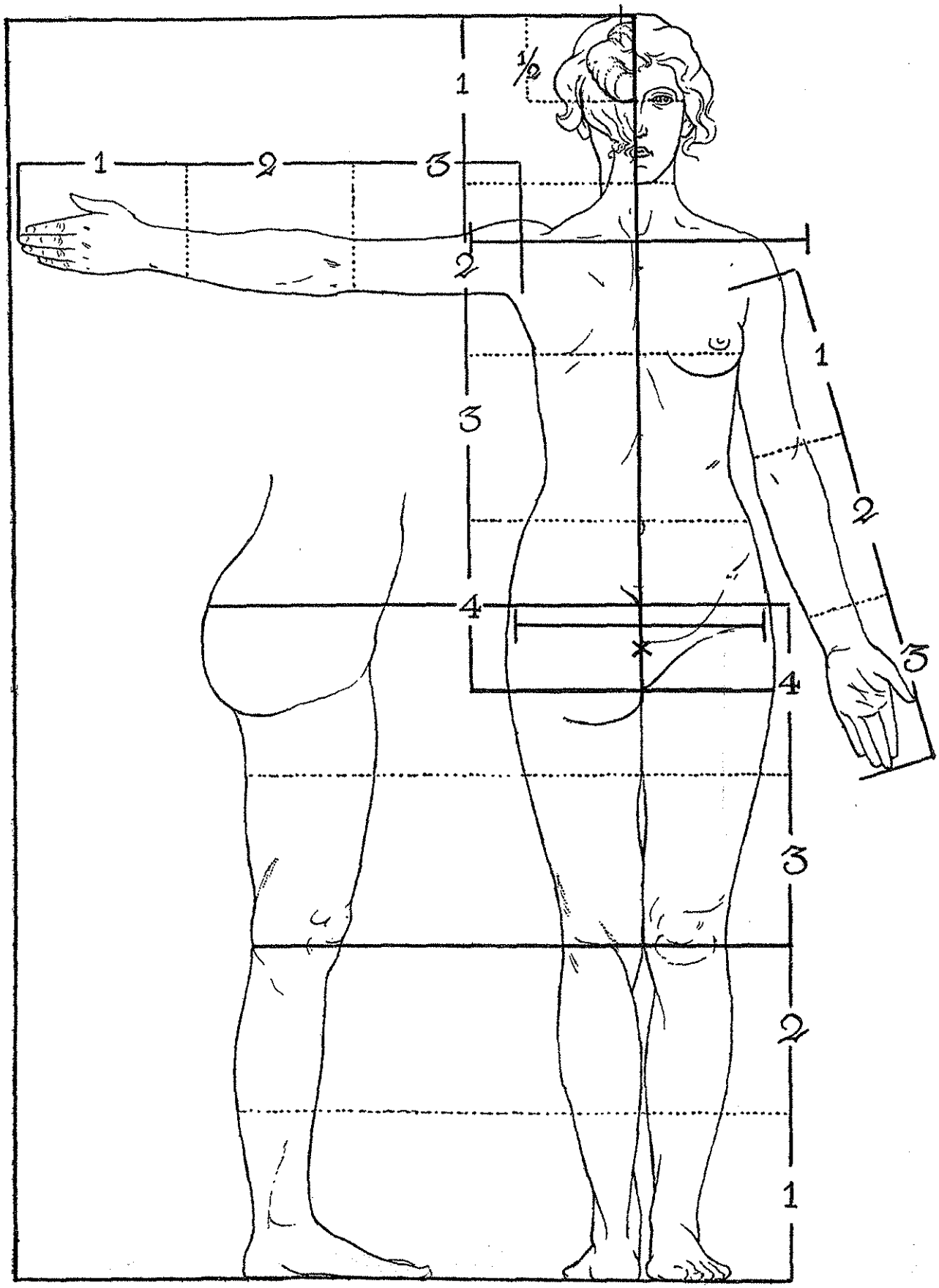

Figure 2: Average female proportions

I have established the following table from my personal measurements. Here, we bring the male and female averages together.

Table I : Average proportions of men and women in absolute measurements[24]

Measuring rod: given as the height from the sole of the foot

	Man	Woman
Vertex: top of the head	167	158.63
Suprasternal notch	136	130.41
Navel	99.6	93.99
Anterior superior iliac spine (ASIS)	93.5	88.32
Great trochanter: top surface	87.4	82.9
Bottom of pubis	82.09	75.06
7th cervical vertebra	141.3	135.04
Iliac tuberosity	96.2	92.38
Top of sacrum	90	87.01
Gluteal fold	76.6	70.66

Calipers

	Man	Woman
Bi-humeral diameter	42.5	36.85
Bi-acromial diameter	39.1	*
Maximum width of thorax	29.4	25.4
Vertical height of thorax	32.06	31.4
Bi-iliac external dimension	28.78	30.1
Bi-iliac anterior dimension	23.87	23.49
Bi-trochanteral diameter	32.6	33.31
Bi-femoral diameter: superior	32	33.65
Bi-iliac posterior dimension	8.87	10.33
Depth of thorax: anterior-posterior	20.4	17.6
Sacro-pubic diameter	19.8	20.68
Total length of upper limb	75.58	69.78
Forearm	45.78	41.54
Middle finger	11.5	10.67
Hand	18.8	17.37
Foot	26.2	24.25

[24] The instrument used to make each measurement is listed in italics; detailed descriptions of these instruments are given in Appendix II. Please note that several values are marked with an *; these values were all left blank in Richer's original text.

Sole of foot to articular plane of knee	45	41.91
Sole of foot to top of medial malleolus	8.58	7.76

Sliding ruler

Height of the head	22.99	21.06

Measuring tape

	Man	**Woman**
Circumference of thorax below the nipples, in exhalation	89.1	71.89
Circumference of the hip at the trochanter	91.4	93.13
Circumference of the waist	*	65.88

Angular Compass

	Man	**Woman**
Sacral angle	62.7°	78.17°
Xiphoid angle	72.5°	60.98°

Compass of inclination

	Man	**Woman**
Inclination of sternum	26.1°	27.67°
Inclination of sacrum	18.6°	29.12°
Weight	64.753 kg	55.002 kg

In this table, we see that the average man of 1.67 m corresponds to the average woman of 1.58 m. Most of the measurements taken from the man exceed those of the woman, which seems quite natural given the difference between their sizes. Thus, I have recorded the following measurements, given in centimeters:

	Man	**Woman**
Length of the head	22.99	21.06
Upper limb	75.58	69.78
Forearm	45.78	41.54
Hand	18.8	17.37
Lower limb: from the iliac spine to the sole of the foot	93.5	88.32
Leg	45	41.91
Foot	26.2	24.25

In contrast, the height of the woman's torso tends to equal that of the man, and can even exceed it slightly if we take the following measurements into account:

	Man	Woman
Suprasternal notch to the gluteal fold	59.4	59.75
Suprasternal notch to the bottom of the symphysis pubis	53.91	55.35

The man's thorax exceeds the woman's in all dimensions:

	Man	Woman
Width: transversal diameter	29.4	25.4
Height: vertical diameter	32.06	31.40
Depth: anterior-posterior diameter	20.4	17.6
Xiphoid angle	72.5°	60.98°
Circumference of the chest	89.1	71.89

It is the same for the width of the shoulders:

	Man	Woman
Bi-humeral diameter	42.5	36.85

But the opposite effect is produced in the lower half of the torso. Here, we see that the woman's pelvis exceeds the man's in all dimensions with the exception of the bi-iliac anterior diameter. This tends to indicate that the woman's pelvis is relatively more closed than that of the man. Here are the measurements I have recorded:

	Man	Woman
Bi-iliac external diameter	28.78	30.10
Bi-iliac anterior diameter (ASIS)	23.87	23.49
Bi-iliac posterior diameter (PSIS)	8.87	10.33
Bi-trochanteral diameter	32.6	33.31
Sacro-pubic diameter	19.8	20.68
Sacral angle	62.7°	78.17°
Circumference of the hips	91.4	93.13

The greater inclination of the woman's pelvis is also apparent from these measurements, taken from the vertical:

	Man	Woman
Inclination of sacrum	18.6°	29.12°

In transforming these absolute measurements into measures scaled relative to a height of 100 units (Table II), the differences observed between men and women increased, except on two points. The vertical diameter of the thorax is greater for women, as well as the length of the hand. One concludes that, in women, the increased distance from the sole of the foot to the suprasternal notch and to the 7th cervical vertebra is a consequence of the greater length of her torso. It is the same for the iliac tuberosity and the summit of the sacrum, whose greater elevation above the sole of the foot seems to result from the greater inclination of the pelvis.

Table II: Average proportions of men and women scaled to a height of 100 units, measured from the height above the sole of the foot

	Man	Woman
Vertex	100	100
Suprasternal notch	81.4	82.21
Navel	59.6	59.25
Anterior superior iliac spine (ASIS)	56	55.67
Great trochanter: top surface	52.3	52.26
Bottom of pubis	49.1	47.31
7th cervical vertebra	84.6	85.12
Iliac tuberosity	57.6	58.23
Top of sacrum	53.8	54.85
Gluteal fold	45.8	44.54

Calipers

	Man	Woman
Bi-humeral diameter	25.4	23.23
Bi-acromial diameter	23.4	*
Maximum width of thorax	17.6	16.01
Height of thorax	19.2	19.79
Bi-iliac external diameter	17.2	18.97
Bi-Iliac anterior diameter	14.2	14.8
Bi-trochanteral diameter	19.5	20.93
Bi-femoral superior diameter	19.1	21.21
Bi-Iliac posterior diameter	5.3	6.51
Depth of thorax: anterior-posterior	12.2	11.09
Sacro-pubic diameter	11.8	13.03

Compass

	Man	Woman
Upper limb, in total	45.2	43.98
Forearm	27.4	26.18
Middle finger	6.8	6.72
Hand	11.2	11.94
Foot	15.6	15.28
From the sole to the articular plane of the knee	26.9	26.41
From the sole to the top of the medial malleolus	5.13	4.89

Sliding Ruler

	Man	Woman
Height of the head	13.7	13.27

Measuring tape

	Man	Woman
Circumference of the thorax below the breasts in exhalation	53.3	45.31
Circumference of the hips at the great trochanter	54.7	58.7
Circumference of the waist	*	41.53

Angular compass:

	Man	Woman
Sacral angle	37.4°	49.27°
Xiphoid angle	40.3°	38.44°

Compass of inclination:

	Man	Woman
Inclination of sternum	15.6°	17.44°
Inclination of sacrum	11.1°	18.35°
Weight	38.600 kg	34.673 kg

To put this average female canon into use for artists, we must proceed as we have for the average male canon. That is to say, we must subdivide it and take one of its parts as a unit of measure. I will use the height of the head for this purpose.

In the application of the same method to both canons, we find new elements of comparison that bring to light their similarities and differences.

In comparing the two canons illustrated here (Figures 1 and 2), we see right away that the limbs divide themselves in exactly the same fashion. In the torso, by contrast, if the similarities persist in its upper half, the differences are accentuated in its lower half as a natural consequence of the greater length of the woman's torso. In women, the lower limit of the torso passes below the reference lines indicated for men. The gluteal fold, for example, descends noticeably below the limit of the 4th head length. And the anterior superior iliac spine is situated below the upper quarter of this 4th head, instead of being just at this point as it is in the man. In consequence, the midpoint of the figure is situated a bit higher. Instead of being situated below the pubis, as in the man, the midpoint is placed just at the upper edge of the pubic symphysis.

One also observes that the total breadth of the figure, from fingertip to fingertip with arms outstretched, is slightly less than the total height of the figure for women, although it surpasses the height for men. This relative reduction of the total breadth of the woman's figure is created in part by the lesser diameter of her thorax, thus the reduction in the width of her shoulders.

Regarding measurements of the width of the torso, the artistic method, using the height of the head and its subdivisions as a unit of measure, does not bring us the degree of precision achieved with absolute measures in centimeters. However, one could note that if, in men, the width of the shoulders measures two heads, it would not achieve that width in women. In contrast, the width of her hip exceeds the width of the male hip. The exact measure of the female hip is 1½ heads.

The large number of female subjects I have measured permits me to compare the large and small body sizes among them. To this effect, all the subjects were classified in order of size. The average of the first fifty represents the large sizes, and the average of the last fifty, the petite sizes. The general average is interposed between the two. A glance over these two tables (Tables III and IV) permits one to see that in absolute measures, all proportions are larger in the larger sizes than the smaller, with the sole exception of the inclination of the pelvis, which increases with the diminution of size.

Table III: Proportions of women in absolute measures of large, average, and petite sizes, measured in centimeters from the height above the sole of the foot

	Large size	Average size	Petite size
Vertex	163.56	158.63	153.70
Suprasternal notch	134.61	130.41	126.20
Navel	92.20	93.99	90.78
Anterior superior iliac spine	91.55	88.32	85.09
Great trochanter: top surface	85.42	82.90	80.38
Bottom of the pubis	77.88	75.06	72.24
7th cervical vertebra	139.28	135.04	130.80
Iliac tuberosity	95.70	92.38	89.05
Top of sacrum	90.38	87.01	83.64
Gluteal fold	73.49	70.66	67.82

Calipers

	Large Size	Average Size	Petite Size
Bi-humeral diameter	37.69	36.85	36.01
Maximum width of thorax	26.08	25.40	24.73
Height of thorax	32.17	31.40	30.63
Bi-iliac external diameter	31.07	30.10	29.13
Bi-Iliac anterior diameter	24.11	23.49	22.86
Bi-trochanteral diameter	34.19	33.31	32.43
Bi-femoral superior diameter	34.54	33.65	32.75
Bi-iliac posterior diameter	10.65	10.33	10.01
Depth of thorax: anterior-posterior	18.01	17.60	17.20
Sacro-pubic diameter	21.47	20.68	19.90

Upper limb in total	71.92	69.78	67.65
Forearm	42.68	41.54	40.39
Middle finger	10.91	10.67	10.43
Hand	17.84	17.37	16.91
Foot	24.94	24.25	23.56
From the sole of the foot to the articular plane of the knee	43.50	41.91	40.33
From the sole of the foot to the top of the medial malleolus	7.99	7.76	7.54

Sliding ruler

	Large Size	**Average Size**	**Petite Size**
Height of the head	21.41	21.06	20.70

Measuring tape

	Large Size	**Average Size**	**Petite Size**
Circumference of the thorax below the breasts in exhalation	73.82	71.89	69.95
Circumference of the hips at the great trochanter	95.49	93.13	90.78
Circumference of the waist	68.06	65.88	63.71

Angular compass

	Large Size	**Average Size**	**Petite Size**
Sacral angle	79.12°	78.17°	77.22°
Xiphoid angle	61.24°	60.98°	60.72°

Compass of inclination

	Large Size	**Average Size**	**Petite Size**
Inclination of the sternum	27.88°	27.67°	27.46°
Inclination of the sacrum	28.26°	29.12°	29.98°
Weight	58.994 kg	55.002 kg	51.010 kg

Table IV: Proportions scaled to a height of 100 units from large to petite women, measured from the height above the sole of the foot

Measuring rod

	Large Size	Average Size	Petite Size
Vertex	100	100	100
Suprasternal notch	82.23	82.21	82.10
Navel	59.42	59.25	59.06
Anterior superior iliac spine	55.97	55.67	55.36
Great trochanter: top surface	52.22	52.26	52.29
Bottom of pubis	47.61	47.31	47.00
7th cervical vertebra	85.15	85.12	85.10
Iliac tuberosity	58.51	58.23	57.93
Top of sacrum	55.25	54.85	54.41
Gluteal fold	44.92	44.54	44.12

Calipers

	Large Size	Average Size	Petite Size
Bi-humeral diameter	23.04	23.23	23.42
Maximum width of the thorax	15.93	16.01	16.08
Height of thorax	19.66	19.79	19.92
Bi-Iliac external diameter	18.99	18.97	18.95
Bi-Iliac anterior diameter	14.74	14.80	14.87
Bi-trochanteral diameter	20.90	20.93	21.09
Bi-femoral superior diameter	21.11	21.21	21.30
Bi-iliac posterior diameter	6.51	6.51	6.51
Depth of thorax: anterior-posterior	11.01	11.09	11.19
Sacro-pubic diameter	13.18	13.03	12.94
Upper limb, in total	43.97	43.98	44.01
Forearm	26.09	26.18	26.27
Middle finger	6.67	6.72	6.78
Hand	10.90	10.94	11
Foot	15.24	15.28	15.32
From the sole to the articular plane of the knee	26.59	26.41	26.23
From the sole to the top of the medial malleolus	4.88	4.89	4.90

Sliding ruler

	Large Size	Average Size	Petite Size
Height of the head	13.09	13.27	13.46

Measuring Tape

	Large Size	Average Size	Petite Size
Circumference of the thorax below the breasts, in exhalation	45.13	45.31	45.51
Circumference of hips at the great trochanter	58.37	58.70	59.06
Circumference of the waist	41.61	41.53	41.45

Angular Compass

	Large Size	Average Size	Petite Size
Sacral angle	48.37°	49.27°	50.24°
Xiphoid angle	37.44°	38.44°	39.50°

Compass of inclination

	Large Size	Average Size	Petite Size
Inclination of sternum	17.04°	17.44°	17.86°
Inclination of sacrum	17.27°	18.35°	19.50°
Weight	36.068 kg	34.673 kg	33.188 kg

But things change if the absolute measures are transformed into relative measures scaled to a height of 100 units. In this case, the head, the upper limb, and the widths of the torso increase in the smaller sizes, as well as the height of the torso, the circumference of the hips, and naturally also the inclination of the pelvis.

In the study of proportions, the method of averages offers serious advantages as we have seen. But it does not preclude the study of individuals, which are always full of teachings, and are uniquely capable of highlighting certain particularities that are concealed by the averages. I will give an example.

It follows from the previous averages that the lower limbs are longer relative to the torso in the large sizes, while the reverse is true in the petite sizes, which are often distinguished by the shortness of their limbs. These findings agree with the generally accepted view, which is true as a whole, that differences in height are mainly at the expense of the lower limbs.

Figure 3 (right): Variations in proportion

Subjects in whom the proportions of the lower half of the body dominate (long legs: A), and those in whom the proportions of the upper half of the body dominate (short legs: B). A horizontal dotted line divides the height of the standing figures exactly in half. On the right, the same subjects are in a seated, crouched position.

Comparisons between these different figures can give rise to interesting observations. For example, one observes differences in the height of the elbow and wrist in comparison to the waist and the pubis, etc. The seated crouched pose makes the relative proportions of the leg and the torso clear in both cases.

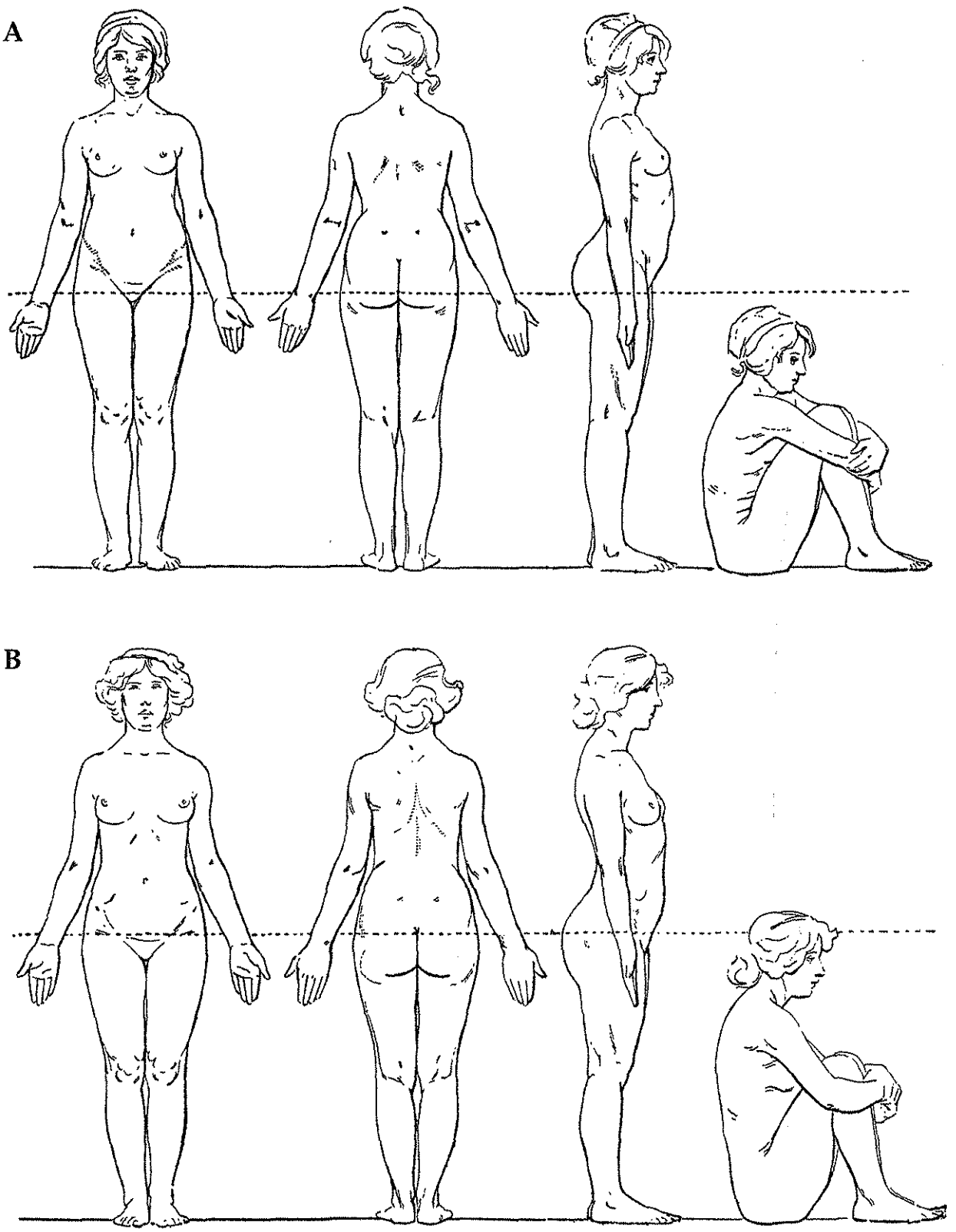

Figure 3: Variations in proportion

But nature likes, so to speak, to break the framework within which we pretend to enclose her and to realize the exceptions to the general rules that tend to establish averages. Thus, it is not rare to observe a short torso on a petite subject, or a long torso on person of large size. And one could find two women of the same height, either petite or large, one with a relatively long torso, the other with a relatively short one. With much wisdom, Dr. Manouvrier brought attention to these two types, for which he created new terms that take into account the length of the limbs.[25] Relative to the size of their torso, he designates the subjects who have short legs by the name *bradyskeletal*, and those who have long legs, *macroskeletal*.

This opposition in length between the two halves of the human figure: the torso and the lower limb, can give rise to a series of interesting observations.

In standing posture with the arms falling naturally along the length of the torso, the wrist does not reach the level of the upper limit of the pubis on the type with short legs, while it descends well below this region on the type with long legs. If we consider the height of the olecranon or the crease in the elbow in relation to the waist, we see that if the legs are short, the waist and elbow are situated at nearly the same level. With long legs, the elbow clearly descends below the waist.

The seated pose will indicate the length of the torso in relation to that of the lower limbs.

The seated crouched pose, like that represented in Figure 3, gives rise to some interesting oppositions. For those with short legs, the knee does not reach the level of the armpit, while for those with long legs, the knee can pass the top of the shoulder. The comparison between these two types can be continued in various other positions and give rise to curious and instructive observations. The artist will find reasons to prefer one type over another in a given posture; from this he will see one of the most striking examples of the importance of the choice of model to represent a given action.

Alongside the proportions in height, there are the proportions in width. Next to individuals who are long, thin, or svelte, there are individuals who are broad, square in shape, barrel-chested, or stocky. These two very different types are granted with various aptitudes and opposing qualities, and, from the point of view of plastic form, express dissimilar ideas. Despite the fullness of her pelvis, the woman, by the general grace of her limbs, is most often found to be the long type.

From this point of view, it is not rare to find a default of harmony in certain subjects analogous to that which creates the long-legged type and the short-legged type relative to proportions in length. I would like to speak about some women for whom the two halves of the body, the upper half and the lower half, seem to belong to different individuals. For example, those for whom the upper half is slender, thin and svelte, yet adapts itself to a lower half that is wide and stocky, with a powerful pelvis and short lower limbs that are solid and thick. In this type there is an exaggeration of normal morphological tendencies that are expressive of opposite meanings, marked by the contrast due to their union in the same subject. Yet this body type can sometimes be brought to good use by the artist. But it is not the same for the opposite type; an individual with a developed torso, powerful shoulders and arms, a narrow pelvis and thin legs, whose contradictory character deviates too much from the normal type to be, in my opinion, advised for use in works of art.

[25] *Bulletins et Mémoires de la Société d'Anthropologie de Paris*, 1902, n°3.

3. Proportions of children

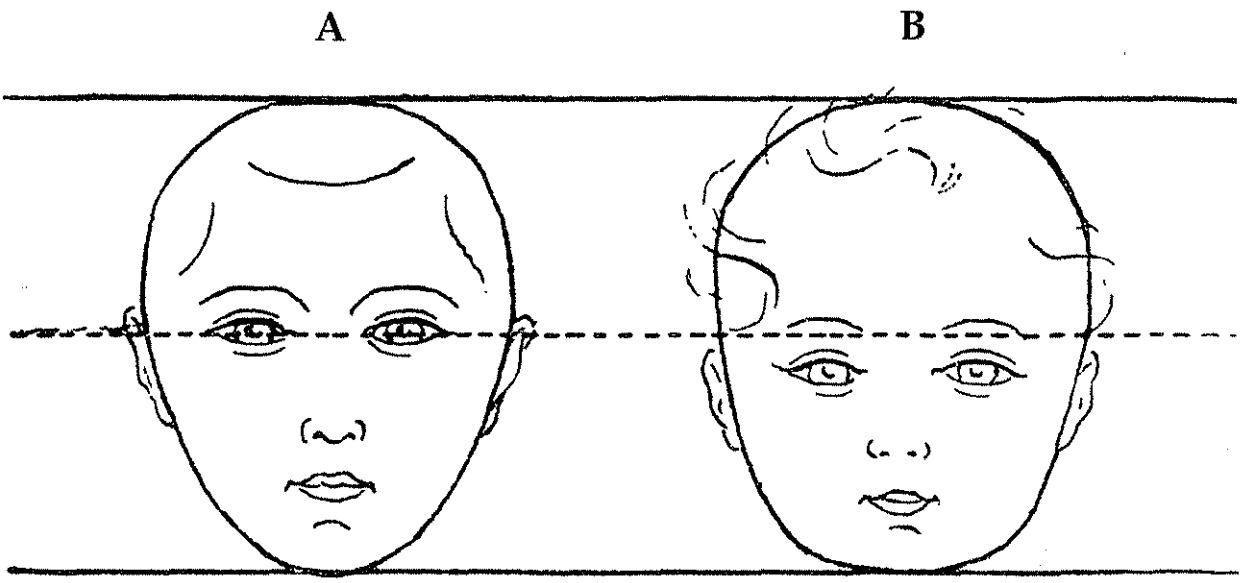

Figure 4: Schematic diagram of an adult's head (A), and a baby's head (B).
A horizontal dotted line passes through the middle of the height of both figures.

Without entering into a detailed study on the laws of growth, I will content myself to explain the principal facts that can help artists to give their figures of children proportions that agree with their different ages. I will borrow most of the following ideas from the works of the wise Belgian anthropologist Quételet.[26]

Growth is quite rapid in the first phase of life and diminishes little by little with the progress of age. The body increases in size until the age of thirty in men, but in a small number of people, only until the age of twenty-five. "In considering the absolute size," says Quételet, "growth becomes proportionally less rapid as one moves further away from the time of birth. In the first year of development, the growth in height is nearly 20cm for girls and for boys; during the second year, one finds this number is reduced by half, and doesn't exceed 10cm. The annual growth is reduced to a quarter, or five centimeters, until twelve years of age, and continues to diminish until around the age of twenty, where it becomes almost nothing for girls; for boys, it ends a bit later."

However, growth undergoes irregularities, and sometimes stops under the influence of certain physiological conditions that are still not well determined. From a certain number of measurements taken at regular intervals, we know that the stoppage of growth accelerates in a clear manner with the approach of puberty. As to the final size of the body, this depends almost entirely on the sex and race of the individual.

With respect to the other dimensions of the body, width and depth, they do not undergo a growth proportional to the growth in height. For example, the width of the torso does not grow proportionally to its height, and it is clear that individuals of small size are generally more stocky than those of tall stature.

From the research of Quételet, one can conclude with sufficient accuracy that at birth, the infant is a bit less than one-third of the total height that he will attain. At three years he has achieved half of his height; around seven years he has two-thirds, and around ten years, three-quarters.

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[26] *Anthropométrie*, 1871.

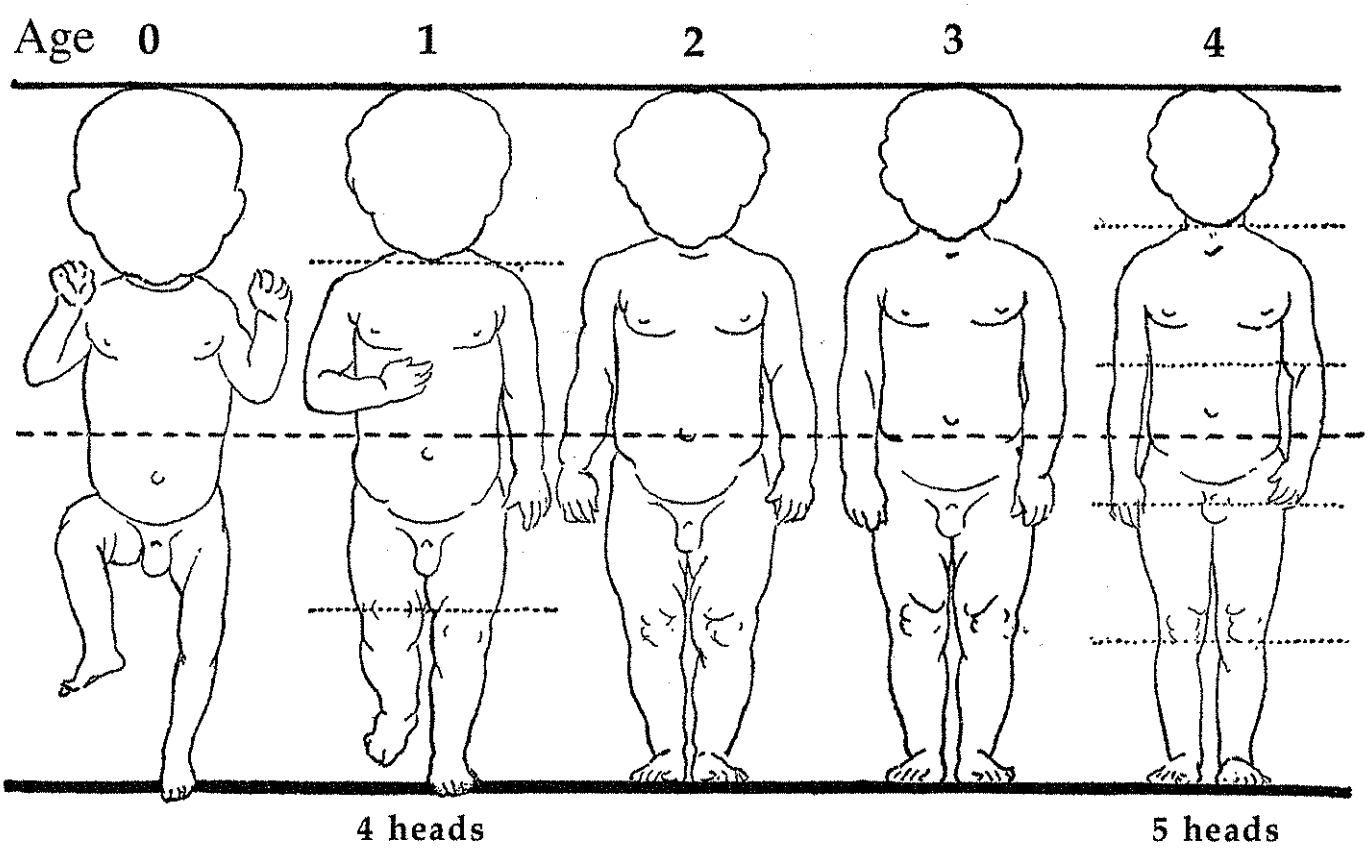
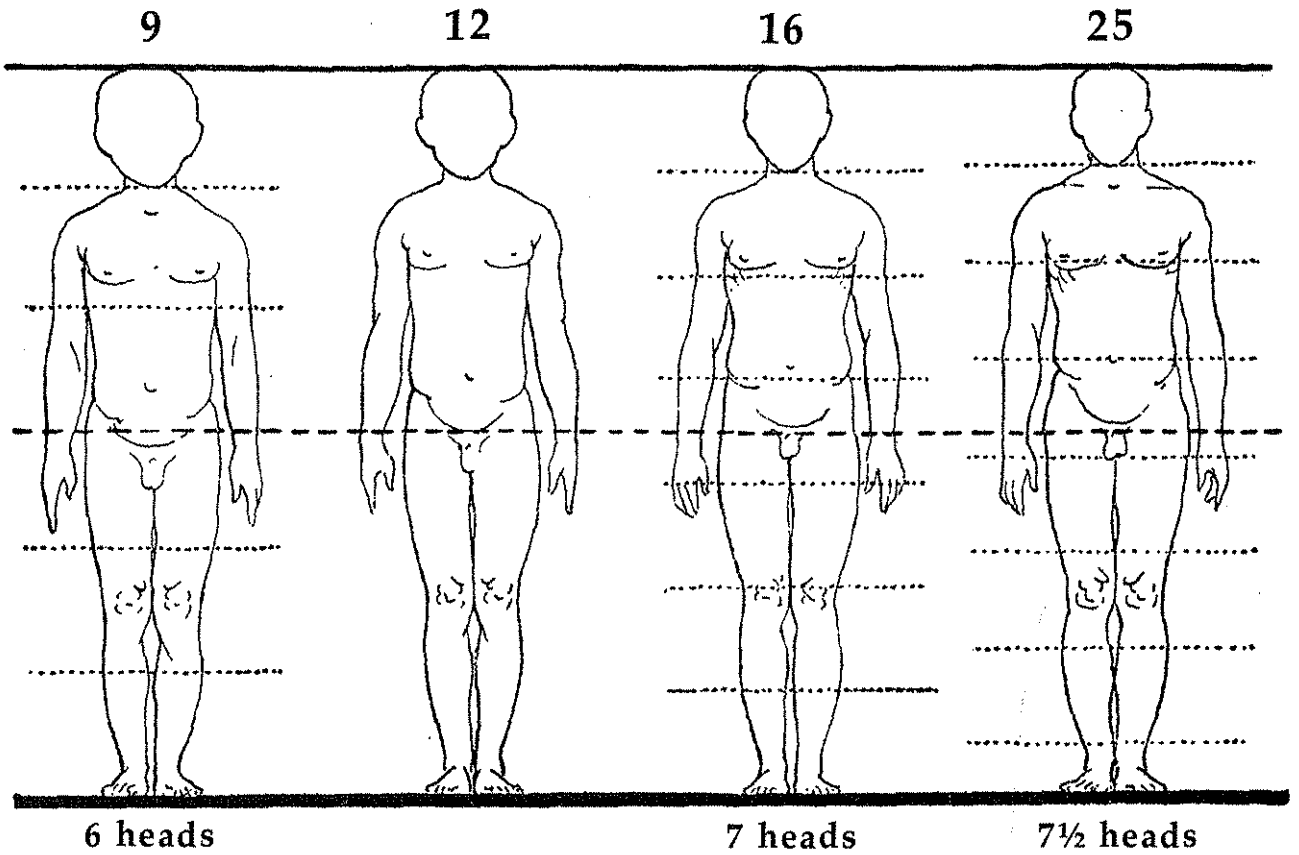


Figure 5 (above and right): Schematic diagrams of a child at different ages. *All the figures are scaled to the same height with a horizontal line dividing them into two equal parts. The numbers above indicate the ages; those below indicate the number of head lengths that comprise the height at 1, 4, 9, 16, and 25 years.*

But it is also important to understand the relative growth of various parts of the body at different ages in order to establish the proportions of the child. And it is again in the works of Quételet that we find the most precise information on this subject.

Generally, one could say that the parts which are most developed at birth are those which subsequently develop the slowest. Quételet said somewhat differently that growth is proportionally larger as one gets farther from the top of the head. This principle demonstrates the facts I have observed, among which the following are most interesting to point out:

- At birth, the height of the head is around half of what it will be after the complete development of the individual. The head develops more in height than in width; all the vertical measurements double, and it is mainly by the lower portion that this growth occurs. Thus, the child's face has the shape of a shorter oval than the adult. The horizontal line that divides the head into two equal parts is located at the level of the inside corners of the eyes in the adult, while in the child it must be placed higher. (Figure 4).
- The neck grows in the same proportions as the head.
- The torso triples its initial height. The width of the thorax is a bit more than doubled, and the depth from the anterior to posterior sides increases by a factor of 2.36.



- The length of the upper limb, without the hand, is doubled by the age of four or five years, tripled between thirteen and fourteen, then quadrupled at the time of complete development.
- The hand is doubled between five and seven years, then tripled by adulthood.
- Of the bones of the upper limb, the bones of the forearm grow with most intensity.
- The length of the lower limb has doubled before the third year, tripled at seven years, quadrupled at twelve years, and quintupled at twenty years. The thigh grows to five times its original length. The lower leg grows proportionally to 5.52 times its original length.

In the child, compared to the adult, one can conclude from the preceding statements that all the limbs are shorter relative to the torso, which gives the torso more prominence. The lower limbs are even shorter than the upper limbs.

In the child, the middle of the body is therefore situated well above the point where it is found in the adult, and its determination according to age will help to establish the relative lengths of the lower limbs and the torso.

At birth, the midpoint of the height of the body is above the navel; at two years it is at the navel; at three it is on the line which joins the hips; at ten it is on the line which joins the trochanters, and at thirteen, at the pubis. In the adult it is situated lower, as we have seen, at the root of the genitals.

For the breadth of the figure with arms outstretched, it is interesting to note that at birth, it is less than the total height. It becomes equal between three and five years. And it is not until the age of fourteen that it passes the height by a subtle measure.

From an understanding of the relationship between the total breadth and height, one can make several statements on the proportions of the upper limb. If we compare the upper and lower limb, here are some interesting observations: around seven years the length of the arm to the end of the fingers equals the height from the bifurcation of the buttocks to the sole of the foot. Before this age the arm is comparatively larger; afterwards it is relatively smaller.

Relative to the height, here are the proportions of the foot and the hand: from five years, the hand is one-ninth of the total body height. At all ages, the foot is around 0.15 or 0.16 of the total height. At ten years, the foot equals the height of the head. Before ten years, the foot is shorter; afterward it is longer.

Finally, the simple relationships between the total body height and the height of the head are as follows. The height of the head comprises within the height of the body:

four times at one year
five times at four years
six times at nine years
seven times in the period of adolescence
seven-and-a-half times in the fully developed adult

I think that the general findings stated above could help artists in the representation of childhood. Without these guidelines, it would be necessary to find a child with proportions specific for each age.

Thus Figure 5, which summarizes the proportions at different ages and only takes into account the location of the middle of the figure and the number of heads comprised in the total height, gives very interesting information to establish the general lines of the figure of a child at any given age.

This research on children's proportions, in spite of the interest that it may have, is almost everything that has been done on the subject. To be more thorough, it would be necessary to specify the same forms in childhood at different ages. One could note that the '*bambini*' of the Renaissance, like the '*amours*' of the 18th century, often show us forms that are too young for their age. So the child with five heads in height, corresponding to the age of four years, who seems to have been specially chosen by the artists to represent childhood, almost always has round forms, full and chubby like a child of one or two years.

I shall not dwell on the gestures and postures given to these children that almost always resemble those of adults, instead of having a clumsiness that is charming and characteristic of youth.

Here is yet another obstacle in the representation of childhood which artists have not always avoided; in wanting to make figures of children, they have sometimes insensitively represented dwarfs. This results from the sole exaggeration, true in essence in childhood, of the length of the torso in opposition to the brevity of the limbs.

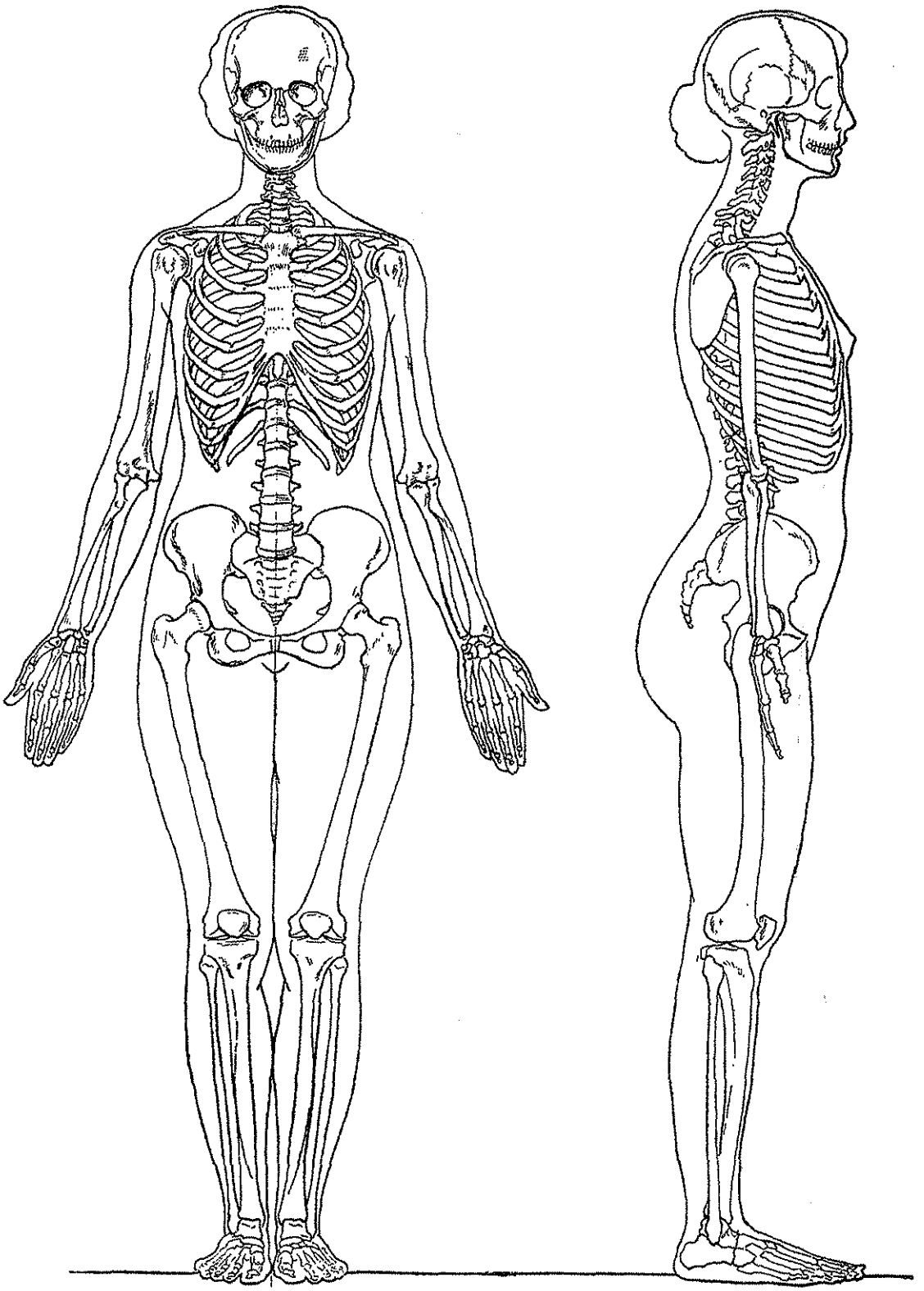


Figure 6 : Female skeleton, anterior and lateral views

Generally speaking, the female skeleton differs from the male by its lesser mass, smoother quality, more delicate ridges, and the imprints of its muscular insertions, depressions, or rough areas being less accentuated. Furthermore, certain parts, such as the skull, the pelvis, the ribcage, and the spinal column, have a specialized conformation that will be discussed later.

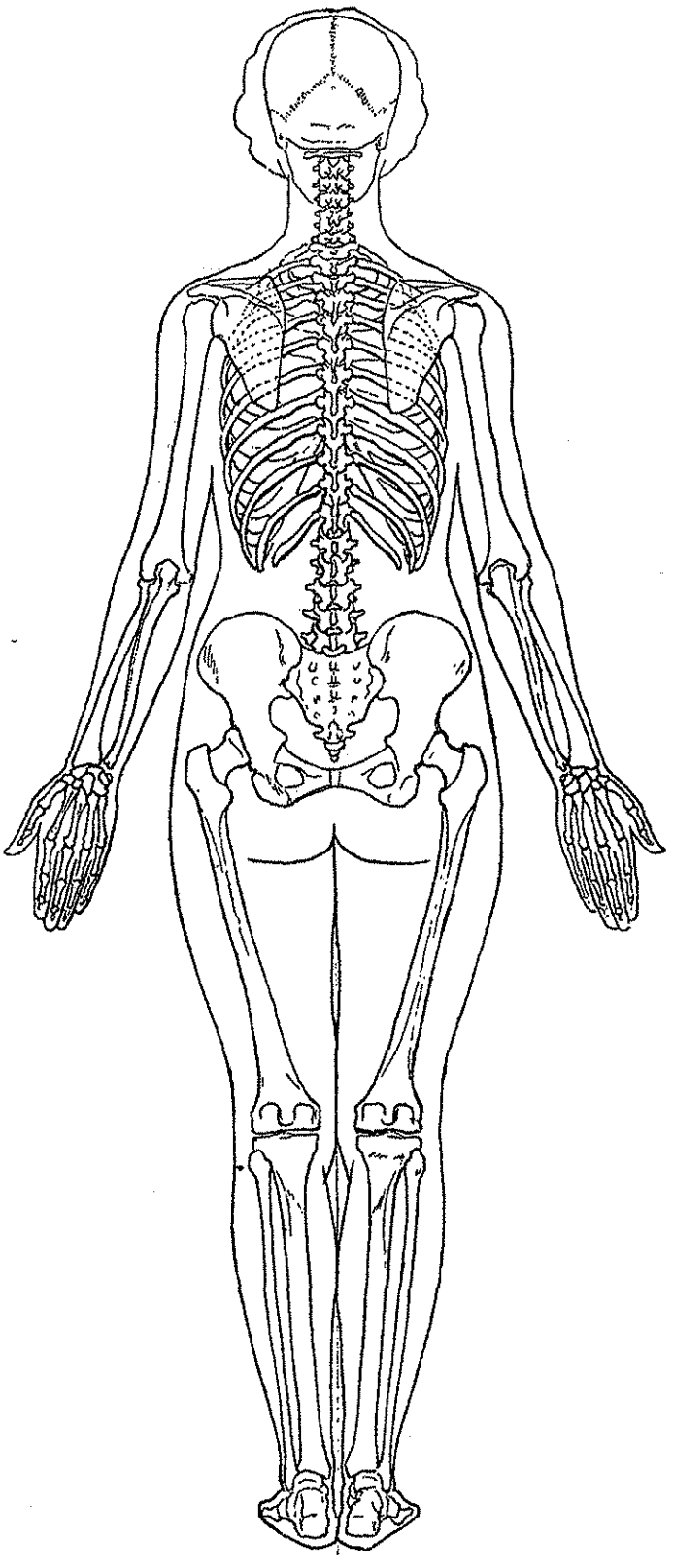


Figure 7: Female skeleton, posterior view

B. Specialized Shapes of the Principal Parts of the Skeleton

Overall, the woman's skeleton is reduced in mass from that of the man. (Figures 6 and 7). The bones are smaller, their surfaces smoother, their edges more delicate, the rough areas that serve for muscular insertions less pronounced. But, in the head and torso, and especially the pelvis, there are special characteristics that deserve a detailed description.

1. Head

First, the feminine skull takes the following traits from the general characteristics of the female skeleton relative to the male: reduced weight and volume, reduced thickness of its walls, a more unified surface with slighter projections from all the ridges, roughnesses, or processes serving as muscular insertions, such as the external occipital protuberance and nuchal lines, the supramastoid crest and the temporal ridge, supraorbital eminence, the mastoid process, zygomatic process, and supraorbital ridge, etc. The contours and the surface of the facial region are more smooth and rounded, while the canine fossae project less. The maxilla and the teeth are less voluminous. The mandible is smaller, with a more open angle, approaching that of the childlike form.

But, apart from these characteristics which are generally caused by a reduced mass and a slighter muscular development, there are others that consist of a somewhat different conformation and which, by influencing the exterior form directly, imprint the feminine skull with its characteristic features.

First, the feminine skull is defined by the more or less complete effacement of the brow ridge, the nasal eminence, and the glabella, which joins the forms of the brow on the median line. Then, the facial part of the frontal bone raises itself almost vertically and rejoins the cranial part with a more closed angle, from which the frontal bones advance more. The parietal eminences are also more developed. Finally, the region of the vertex is flattened throughout. It is interesting to recall that the projection of the frontal and parietal eminences are two characteristics of the child's skull.

The masculine skull is distinguished by the relief of the brow ridge and nasal eminence, which sit below a forehead with a receding aspect.

It should be added that not all feminine skulls are so clean and precise in the qualities I have stated above. There are those feminine skulls that present some masculine forms, and likewise, counterparts exist for masculine skulls that express some feminine qualities. It is nonetheless true that the most pure feminine type is that in which the skull presents the specific characteristics I have indicated.

The newborn's skull (Figure 9B)

What strikes us first upon examination of the infant's skull at birth is the difference in volume between its facial and cranial portions: a greatly reduced face below a voluminous cranium. This difference, which I have already mentioned in the chapter on proportions, remains one of the major characteristics of the child's head and only subsides bit by bit with the progress of age.

Relative to the feminine skull, I have already mentioned other characteristics of the infant's skull, including an exaggerated projection of the frontal and parietal bones, which constitute true eminences. It should also be added that there is considerable effacement of the inferior mandibular angle in a jaw without teeth.

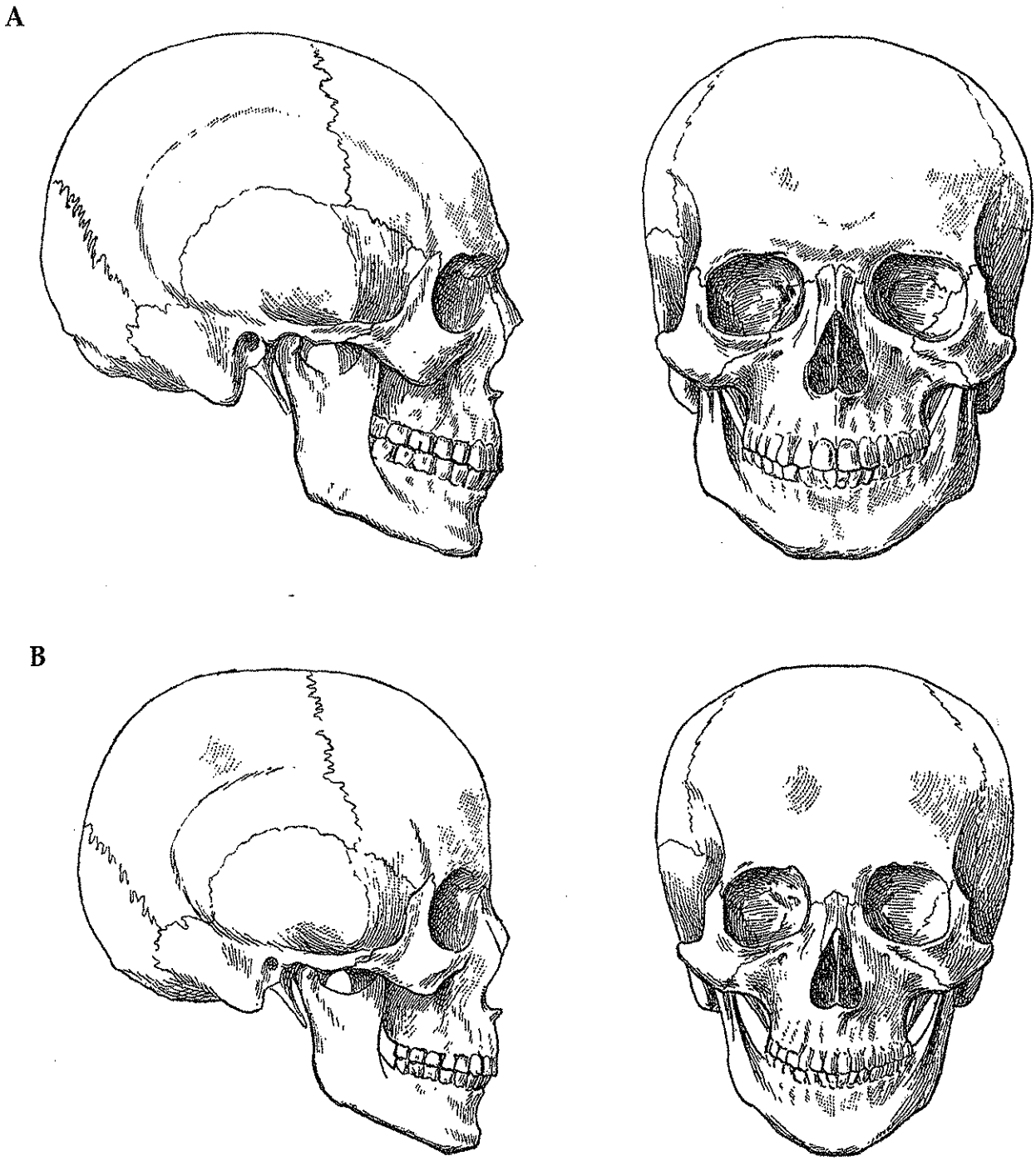


Figure 8: Comparison of masculine and feminine skulls

A. Masculine skull:

- *Projection of the brow ridge and nasal eminence beyond the root of the nose*
- *Projection of the forehead at an inclined angle*

B. Feminine skull:

- *Effacement of the brow ridge and the nasal eminence*
- *Vertical forehead continuing directly with the nasal bones*
- *Flattened vertex*
- *Projection of frontal and parietal eminences.*

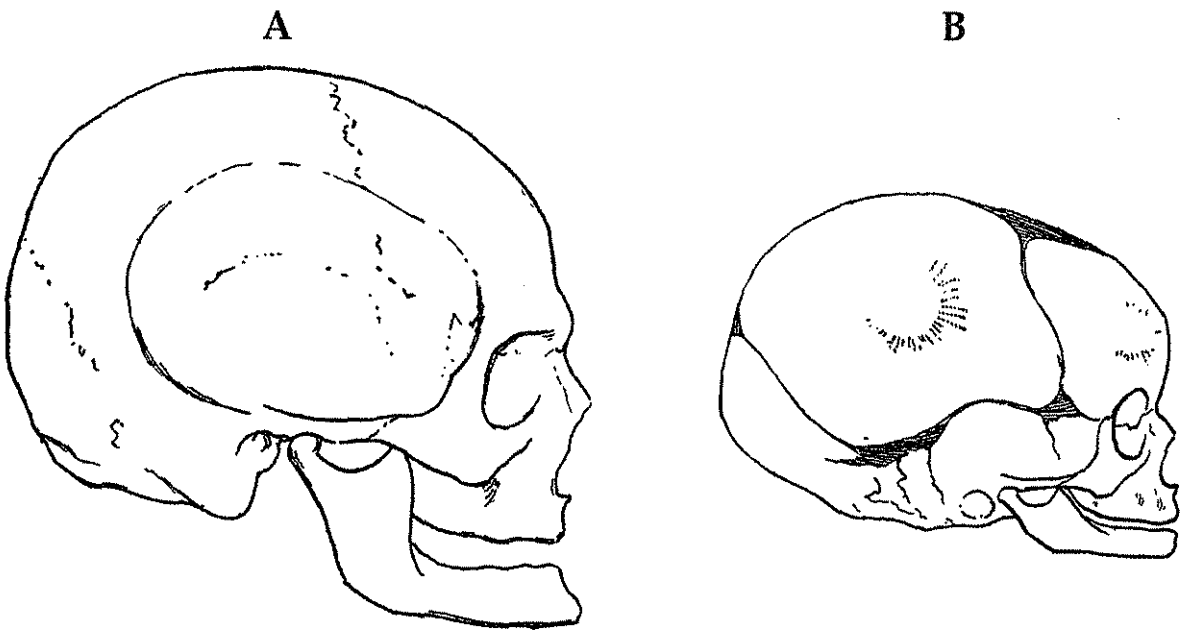


Figure 9: Elderly skull (A), newborn skull (B)

Finally, the different bones that compose the skull do not knit together like those of the adult. Their edges are contiguous and joined together by membranous sutures that permit them to move over one another with a slight overlap. But the sutures do not permit an equal play between all the pieces they connect. From certain given conditions, there is a reduction of different diameters of the skull designed to favor the mechanism of birth.

In addition to the linear membranous paths that form the sutures, there are larger membranous spaces at the meeting points between various corners of the bones of the skull called *fontanelles*.

There are six fontanelles. Two are superior and medial. The anterior fontanelle is large, quadrilateral, and found at the junction of the two parietal bones and the frontal bone. The posterior fontanelle is a small triangular space situated at the junction of the parietal bones and the occipital bone, which is at the lambdoidal and sagittal sutures. The four other fontanelles are situated in pairs on each side of the skull: one anterior lateral pair and one posterior lateral pair. These are found at the meeting places of the bones of each region and are very small.

The progress of ossification reduces the fontanelles bit by bit; first the lateral ones, then the superior ones, which do not disappear completely until around two years of age. I have sometimes seen them persist even in the adult.

At birth, the frontal bone is formed of two symmetrical halves joined by a suture, which persists for a long time and does not entirely disappear until the age of twenty years. The growth of the bones of the skull ends with the obliteration of the sutures, which takes place around the age of thirty years.

The skull in old age (Figure 9A)

The senile characteristics of the skull consist of ankylosis, the last term of the obliteration of the sutures. There can also be trophic problems in old age that bring a thinning of certain bones, most often the parietal, coinciding with a thickening at other points.

But, from the morphological point of view, the most striking quality of the skull of an elderly person is its similarity, to a certain point, to that of an infant due to a diminution in the height of the face. This occurs from the loss of teeth and the resulting atrophy of the alveolar processes. This reduction of the height of the face is combined with the forward projection of the chin in the elderly, which can advance toward the end of the nose. At the same time, the lips, which are no longer held by the dental armature, have a tendency to retreat into the mouth.

The forward projection of the chin is also due to another curious cause, consisting of the opening of the maxillary angle as a sort of return to the infantile form. At birth, this angle is between 150° and 160.° With the progress of age, it closes, and in the adult, is between 110° and 120.° In the elderly, when the teeth have fallen out, it returns to between 130° and 140,° dimensions similar to infants whose teeth have not yet erupted.

2. Spinal Column

Differences exist in the lumbar region between the two sexes (Figures 6 and 7). Thus, the lumbar curve is more accentuated in women; on this point, all anatomists are in agreement. This is combined with a greater inclination of the pelvis to achieve the lumbar curve, also called lordosis, which in general distinguishes the feminine sex.

As for the height of the lumbar spine, for a long time it was considered to be greater in women, resulting in an increased height of her abdominal cavity, and thus being better adapted to gestation. But the latest research by Papillault and Charpy is more precise; they agree that women have a slightly shorter lumbar column than men, all other proportions equal. If the woman's figure is longer and thinner overall, one has to find the explanation in a more constricted lower thorax and a shorter pelvis, rather than a longer dimension of the lumbar spine.

3. Thorax

In men, the well-developed thorax is greater in width than in depth. Its base is well dilated, with its maximum width at the eighth rib. The xiphoid angle[27] exceeds 80.° The last ribs are only slightly reduced in size from the maximum.

According to my findings, here are the average measurements of the male ribcage:

Width: maximum transverse diameter	29.40 cm
Depth: maximum anterior-posterior diameter	20.40 cm
Height: maximum vertical diameter	32.06 cm

It is generally agreed that the feminine torso has a short sternum and a more pronounced constriction in its abdominal portion, ending in a finer waist. It expresses more rounded forms, in contrast to the male type, whose sections tend to be cut more squarely. According to my observations, the feminine thorax is distinguished by a relative predominance of the vertical dimension.

[27] The *xiphoid angle* is the angle between the two edges of the anterior opening of the thorax. It is formed by two lines that follow the edges of the costal cartilage and meet at the xiphoid process.

Here are the average dimensions of the female ribcage:

Width: maximum transverse diameter	25.40 cm
Depth: maximum anterior-posterior diameter	17.60 cm
Height: maximum vertical diameter	31.40 cm

Now, if we compare these measurements with those of the masculine thorax, we find that the feminine thorax is reduced in all directions. However, the degree of difference varies between the different dimensions; it is 4 cm for the width, 2.8 cm for the depth, and only 0.66 cm for the height.

It follows that the height of the ribcage, which is only slightly less than that of the man, remains relatively large in women. In comparison, the other dimensions of the woman's thorax are clearly smaller than those of the man.

Charpy distinguishes three types of ribcage in women: a wide type, a round type, and a long type. According to my observations, the long type is observed most frequently. The length of the ribcage is consistent with the tapering of its lower half and the diminution of the xiphoid angle.

In women, the average xiphoid angle is 60,° while in men it is 72.° The average thoracic circumference is 71 cm in women and 89 cm in men.[28]

4. Pelvis

The pelvis is the most differentiated part of the woman's entire skeleton because its form is directly related to the special functions that are assigned to it. A woman's pelvis is wider and less tall than that of a man. I have observed the following measurements:

	Male	**Female**
Maximum width of the iliac crest	28 cm	30 cm
Total height of pelvis	20 cm	18 cm

These differences in proportion are already quite characteristic. But in examining the shapes in detail, one can also establish that in women, the iliac fossae are wider, more flared, and generally more projected outwards; the sacrum is more concave, wider at its base, and less tall; the pelvic cavity is lower and more spacious; the inferior strait is wider, the symphysis pubis is less high; the pubic arches are opened wide and directed towards the outside; the ischia are wider apart; the large sciatic notch is more open and less deep; the total inclination of the pelvis is more pronounced; finally, the two acetabula are farther apart, which results in a more oblique angle in the femurs.

The measurements I have recorded above permit us to establish that, even in an absolute fashion, the woman's pelvis exceeds that of the man in all dimensions except one: the maximum height. In addition to the general characteristics of the feminine pelvis, there are several individual variations that are important from the morphological point of view. We will examine these next.

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[28] Text removed to Appendix III

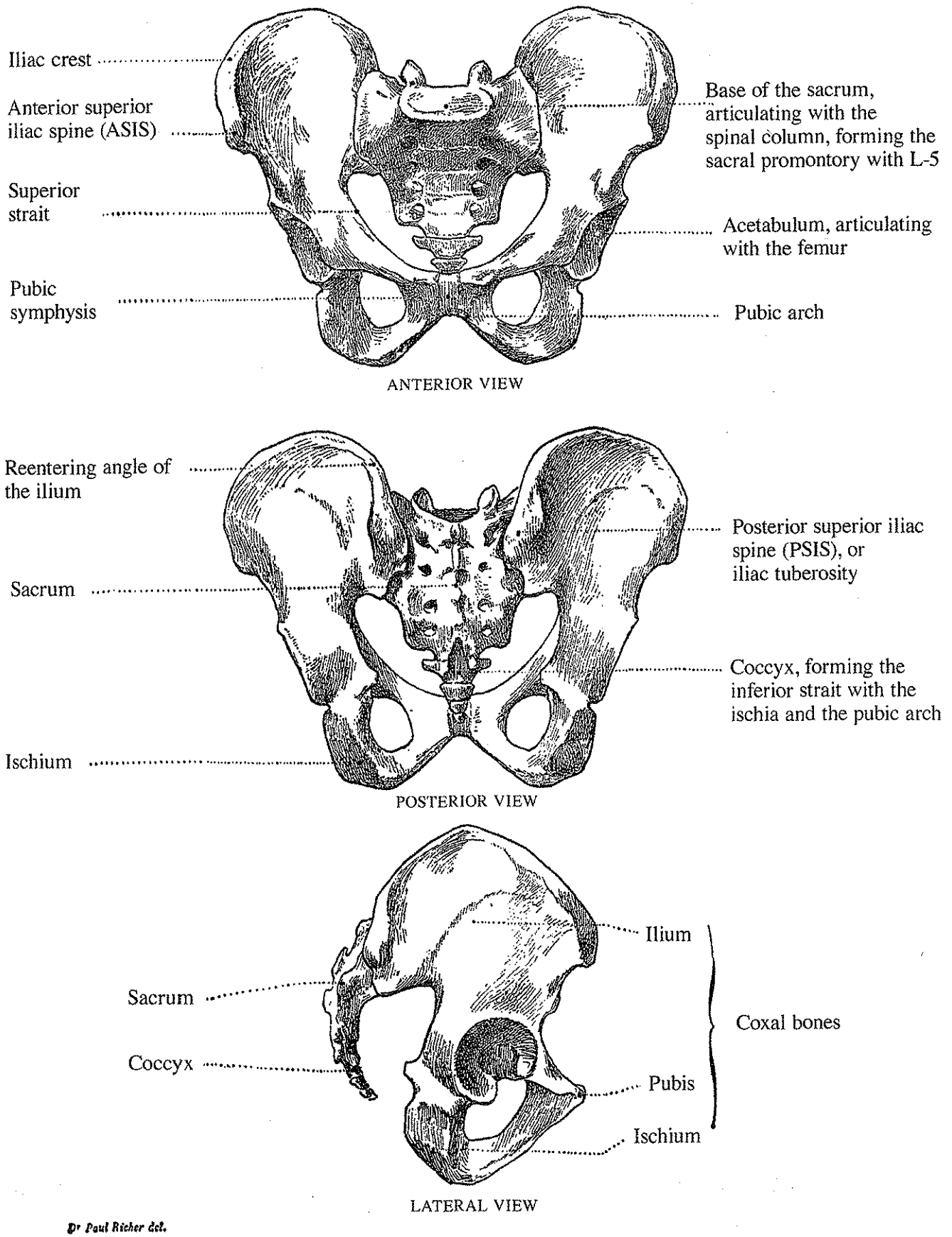

Figure 10: Male pelvis

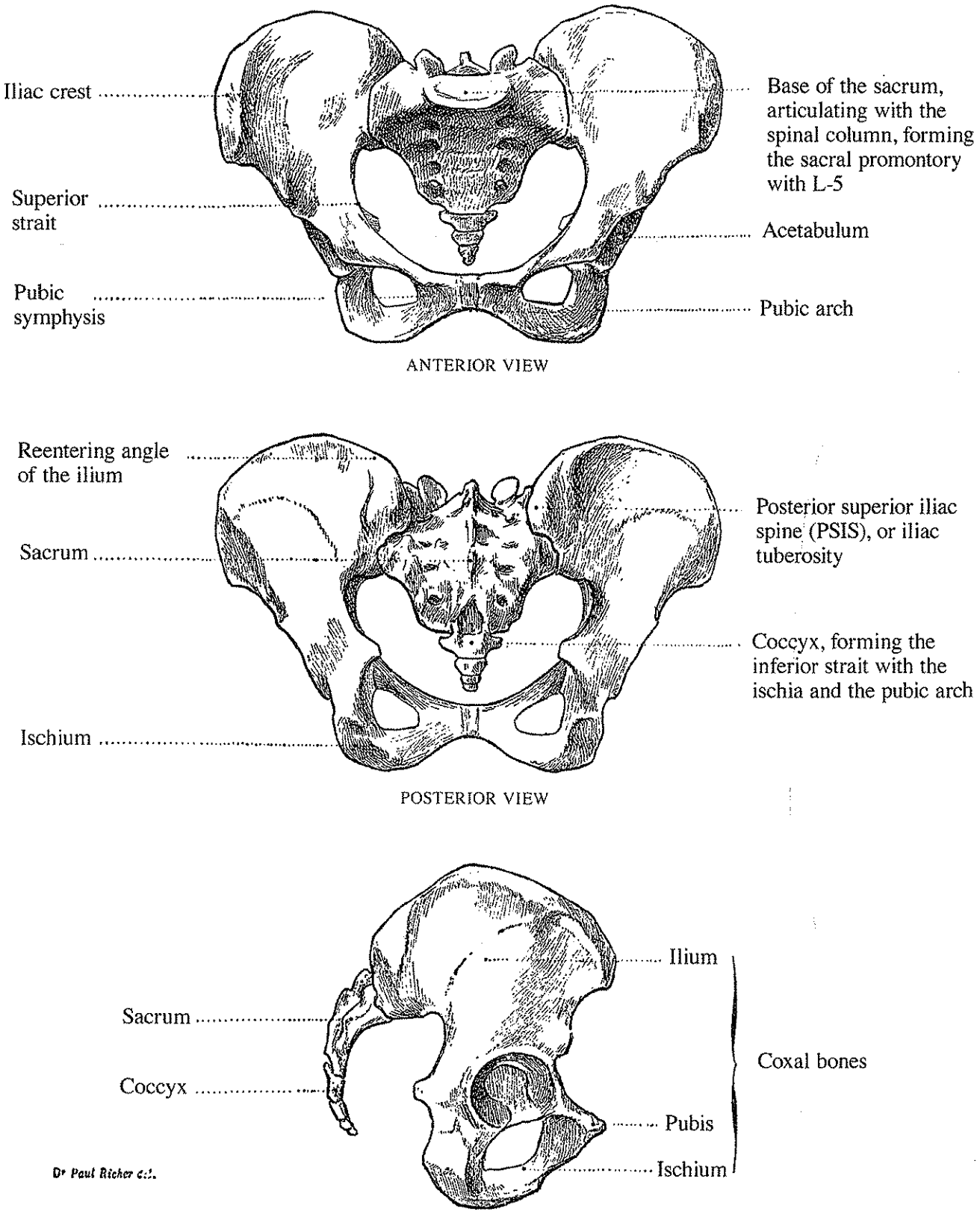

Figure 11: Female pelvis

The woman's pelvis differs from the man's in that, in general, it is less tall and more wide. Moreover, the iliac fossae are farther apart, the sacrum is more concave and shorter, the superior strait of the pelvis is more spacious, the inferior opening is larger, and the pubic arches are more open.

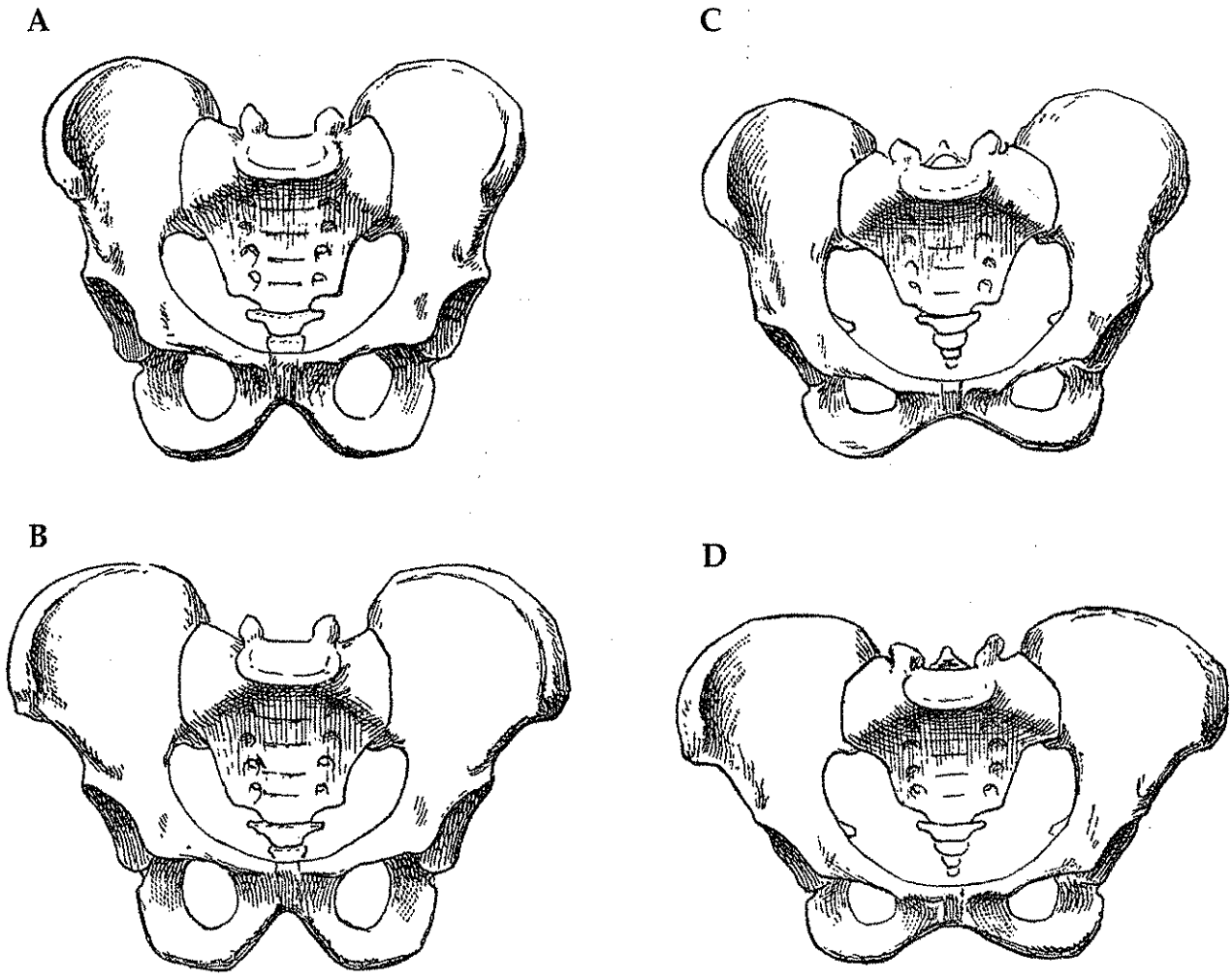

Figure 12: Closed pelvis and open pelvis.
At left, two examples of the male pelvis: A and B. At right, two examples of the female pelvis: C and D. Above, the closed pelvis: A and C. Below, the open pelvis: B and D.

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a. Open Pelvis and Closed Pelvis

In animals, the pelvis is long and narrow and the anterior superior iliac spine is inclined outwards instead of turning towards the median line. Thus, the bi-iliac anterior diameter is greater than the bi-iliac external diameter, contrary to their relationship in the human species. Without ever reaching this conformation, there are cases in which the human form tends to approach it.

The bony belt formed by the pelvis is separated into two parts by the superior strait, which is the oval cavity formed by the internal surface of the sacrum, the iliac bones, and the pubic bones. Above it is the '*greater pelvis,*' and below, the '*lesser pelvis.*' The lesser pelvis, which begins at the superior strait, ends with another narrow part below: the inferior strait. Only the dimensions of the lesser pelvis and its straits are important for the regular birthing process. The proportions of the greater pelvis can vary without a great influence on gestation.

On the subject of the greater pelvis, there are numerous individual variations both in women and in men. Two opposite types are noted: the pelvis that opens widely, and the closed pelvis.

In the open pelvis, (Figure 12: B, D) the coxal bones flare out. As the two iliac crests spread apart, the iliac spines are projected outwards. The pelvis opens itself forwards. In this case, the dimensions of the bi-iliac anterior diameter approach those of the bi-iliac external diameter, without ever equaling it.

In the closed pelvis (Figure 12: A, C), to the contrary, the coxal bones sit up, the iliac crests orient themselves transversally and the iliac spines approach one another: the pelvis closes itself. The dimension of the bi-iliac anterior diameter diminishes, and is significantly less than the bi-iliac external diameter.

Therefore, it is an error to consider the tightening of the circumference of the pelvis, which is the closed-pelvis type, as one of the obligatory characteristics of the male form. Both types, open and closed, are encountered in both sexes. According to Charpy's statistics, the open pelvis could even be found a bit more often in men, in whom one sees the most pronounced types.

If we consider only the difference between the size of the bi-iliac external diameter and the bi-iliac anterior diameter, which reflects the degree of curvature in the anterior half of the superior circumference of the pelvis, the numbers indicate a greater tendency towards the closed pelvis in women. The difference in width between these two measurements averages 6.61cm in women, whereas in men it is only 4.91 cm.

It follows that there are some men with an open pelvis and some women with a closed pelvis. Although these individual variations seem to go against the current notion, true in essence, of a wide pelvis for women and a narrower pelvis for men, these variations have the advantage of putting a limit on the exaggerations that some artists make in this regard. This also helps to highlight an important fact that I have stated in my courses for a long time: the narrowness of the male pelvis cannot exceed a certain degree, since a beautiful width of the hips makes part of a good and solid conformation. Similarly, in women, the width of the hips cannot be exaggerated without exceeding the bounds of a normal constitution.

These two types of pelvis play an important role in the exterior forms of the lower abdomen and groin, as we will see when we treat the morphology of these regions. In a man, the open pelvis contributes to achieving the wide type, which also exhibits a powerful thorax, developed in width, and massive limbs endowed with muscles of a beautiful volume.

b. Position of the Sacrum

The sacrum may be positioned more or less deeply between the two coxal bones so that the promontory, which is to say the angle formed between the lumbar spine and the sacrum, can be situated lower or higher in relation to the superior strait of the pelvis. In the type with a high promontory, the distance that separates the iliac crest from the last ribs increases and the proportions of the height of the flank are augmented. It is the reverse in the type with a low promontory, which is accompanied by the brevity of the flank.

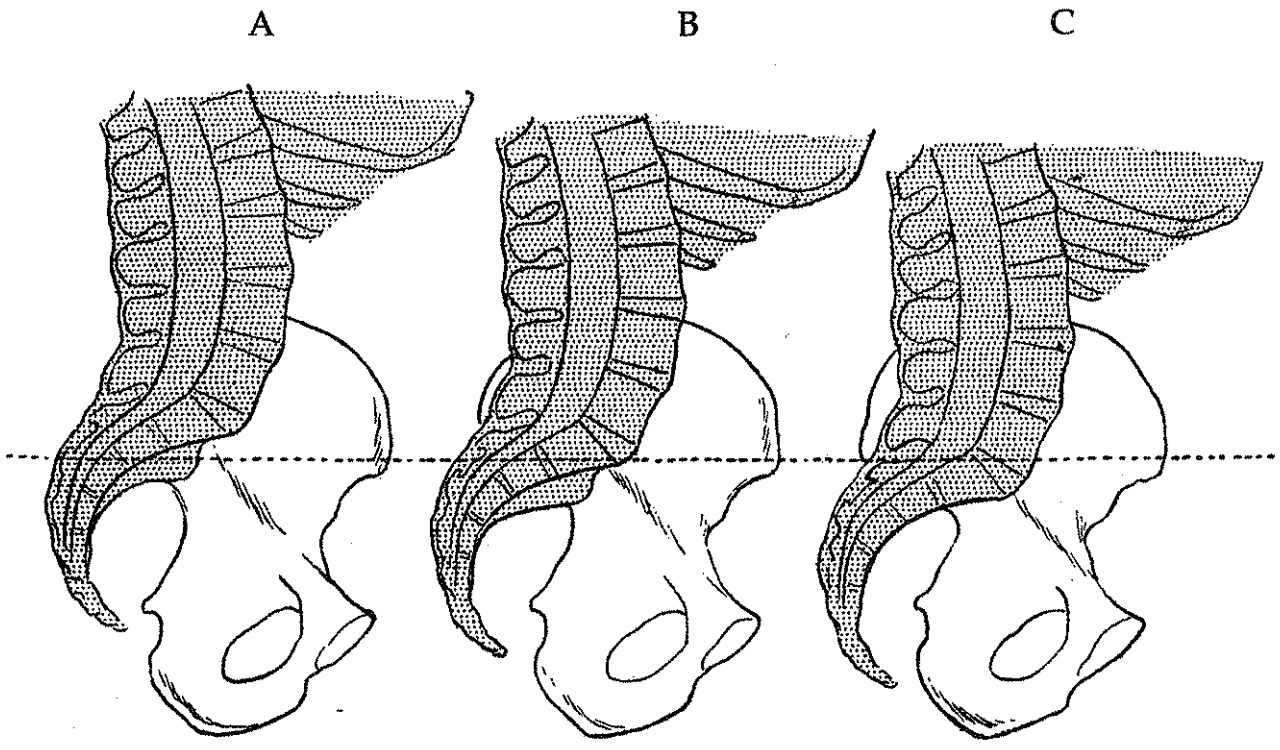

Figure 13: Position of the sacrum in relation to the pelvis.

A: Sacrum placed high B: Average position C: Sacrum pushed into the pelvis

A different height of the flank will result in the three cases, as one will notice on these diagrams by the space that separates the last rib from the iliac crest. A dotted horizontal line passes through the three figures at the same level of the coxal bone.

According to Charpy, of 80 pelvises examined, the difference in height varied between 35 and 50 millimeters. The type with a low promontory was found in 25% of these subjects, the high type in 20%; the rest were the middle type. Within a few percentage points, the two sexes presented the same numbers of the three positions of the sacrum.

c. Orientation of the pelvis

In the living person, the pelvis is hardly ever vertical, except in the seated posture with the ischia resting on the seat. In standing posture, it is clearly inclined so as to present its superior circumference in front. This inclination varies with individuals, but one could consider an average degree of inclination to be the position in which the anterior edge of the pubis and the two anterior superior iliac spines are placed in the same vertical plane.

One only has to observe a few models to notice variations in the sinuous line that follows the posterior contour of the lower half of the torso. This line first traces the concavity of the lumbar spine. Next, it defines the convexity of the sacral region and the buttocks. At the loins, it reveals the variations in curvature of the lumbar spine. At the sacrum, it reflects the inclination of the pelvis. All together, it reproduces that which is known as the *ensellure*, or curvature, of the back.

Charpy showed that the curvature of the loins undergoes many variations depending on the individual, and that it is always a bit more pronounced in women than in men. But the variations in pelvic inclination are more significant and play a greater role in the development of curvature at the loins.

The inclination of the pelvis has particularly attracted the attention of anatomists. This inclination was first sought in relation to the spinal column. But when we speak of the pelvic tilt, we imagine a view of the pelvic inclination on an ideal horizontal or vertical line. Most authors have chosen the anterior-posterior diameter of the superior strait to represent the axis of the pelvis. Mindful of the difficulty of measuring this on the living subject, Charpy instead used the axis of the symphysis pubis which, easily accessible on the cadaver, is much less certain and more delicate to access on the living. The results he obtained from the cadaver are of great interest because they establish, in indisputable fashion, the widespread individual variations in pelvic inclination outside of the influence of attitude and posture. On 116 subjects, he found that the angle of the symphysis pubis varies from 45° to 70° from the vertical. The angle of 45° corresponds to that which I call the *straight pelvis*, and 70° to the *inclined pelvis*.

In my research from the living model on this subject, I have used another method that is very easy to apply. It consists of measuring the inclination of the posterior face of the sacrum with the aid of a special compass.[29]

Degree of inclination of the sacral surface, measured from the vertical:

- Of 30 men, the average is 18° with a minimum of 6° and a maximum of 30°
- Of 100 women, the average is 29° with a minimum of 17° and a maximum of 43°

The subjects observed can thus be grouped according to the degree of inclination:

Of 30 men:

The straight pelvis measures	From 6° to 12°
The average pelvis measures	From 12° to 20°
The inclined pelvis measures	From 20° to 30°

Of 100 women:

The straight pelvis measures	From 17° to 25°
The average pelvis measures	From 25° to 36°
The inclined pelvis measures	From 36° to 43°

In each of these categories, I counted:

Straight pelvis	25 subjects
Average pelvis	61 subjects
Inclined pelvis	14 subjects

From these figures, it follows that:

- The inclination of the pelvis is clearly greater in women than men.
- The number of women with a pelvis of average inclination is greatest (61), followed by those with a straight pelvis (25); those with the inclined pelvis are fewest in number.

[29] This compass is made of a plate of wood with an arm consisting of a copper stem with a water level fixed on it. The wooden plate was placed on the sacral region and kept in position by lightly holding it with one hand. Then, the other arm of the compass was raised to the horizontal; the water level fixed on this mobile branch of the compass permits one to obtain perfect horizontality. A graduated semi-circle gives the measure of the angle made between the wooden plate and the vertical.

If one wanted to select only subjects in whom the inclination of the pelvis agrees exactly with the average of 29,° then one could consider the inclined pelvis to measure more than 29° and the straight pelvis to measure less than 29.° This way, I counted:

At 29°	10 subjects, average pelvis
Above 29°	50 subjects, inclined pelvis
Below 29°	40 subjects, straight pelvis

In this case, the predominance of inclined pelvises (50) over straight pelvises (40) comes from the proportion that exists within the average group (61) between the average pelvis (10), the inclined pelvis (36), and the straight pelvis (15). Hence, for those in the vicinity of the average inclination, the number of inclined pelvises is greater than the straight pelvises, whereas if we consider the extreme degrees, the number of straight pelvises is greater.

The inclination of the pelvis varies with different postures. It diminishes in the seated posture. It increases in the kneeling posture as much for men as for women. This is caused by the inflexibility, beyond a certain degree, of the rectus femorus muscle of the thigh. This muscle is distended with flexion of the knee and pulls the anterior border of the pelvis toward itself. In contrast, flexion of the thigh towards the trunk in the seated posture liberates the pelvis and permits it to sit itself up until it arrives at the vertical position.

C. Width of the Torso

In the differentiation of the sexes, differences in the width of the torso are of primary importance.

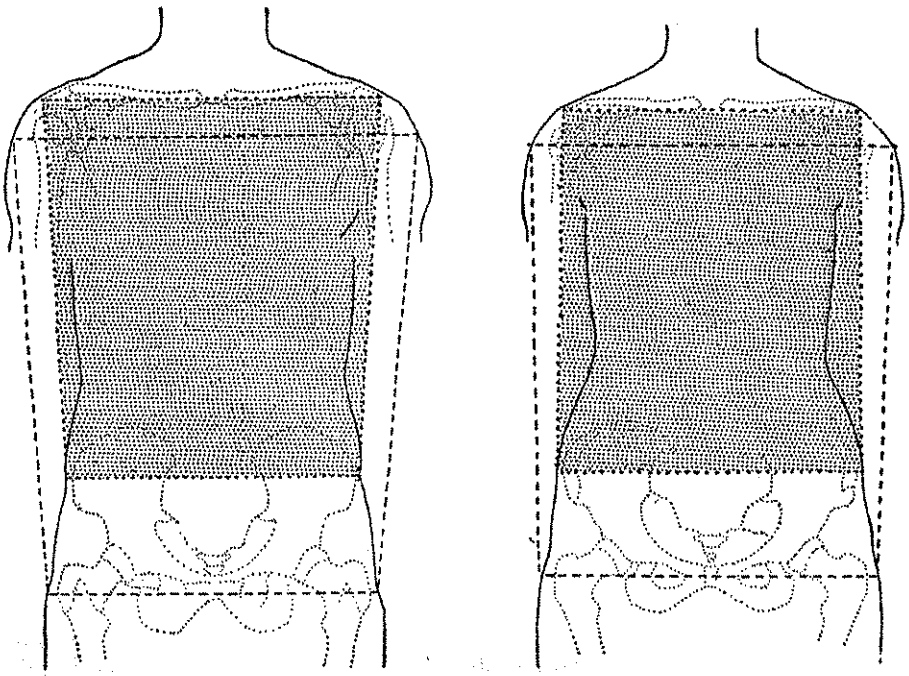

Figure 14: Width of the torso in men and women.
The dashed lines indicate the diameters of the roots of the limbs on the surface of the body: the bi-humeral and bi-trochanteral diameters. The dotted lines, marking the shaded trapezoidal areas, indicate the diameters measured on the skeleton of the torso itself: the bi-acromial and bi-iliac diameters.

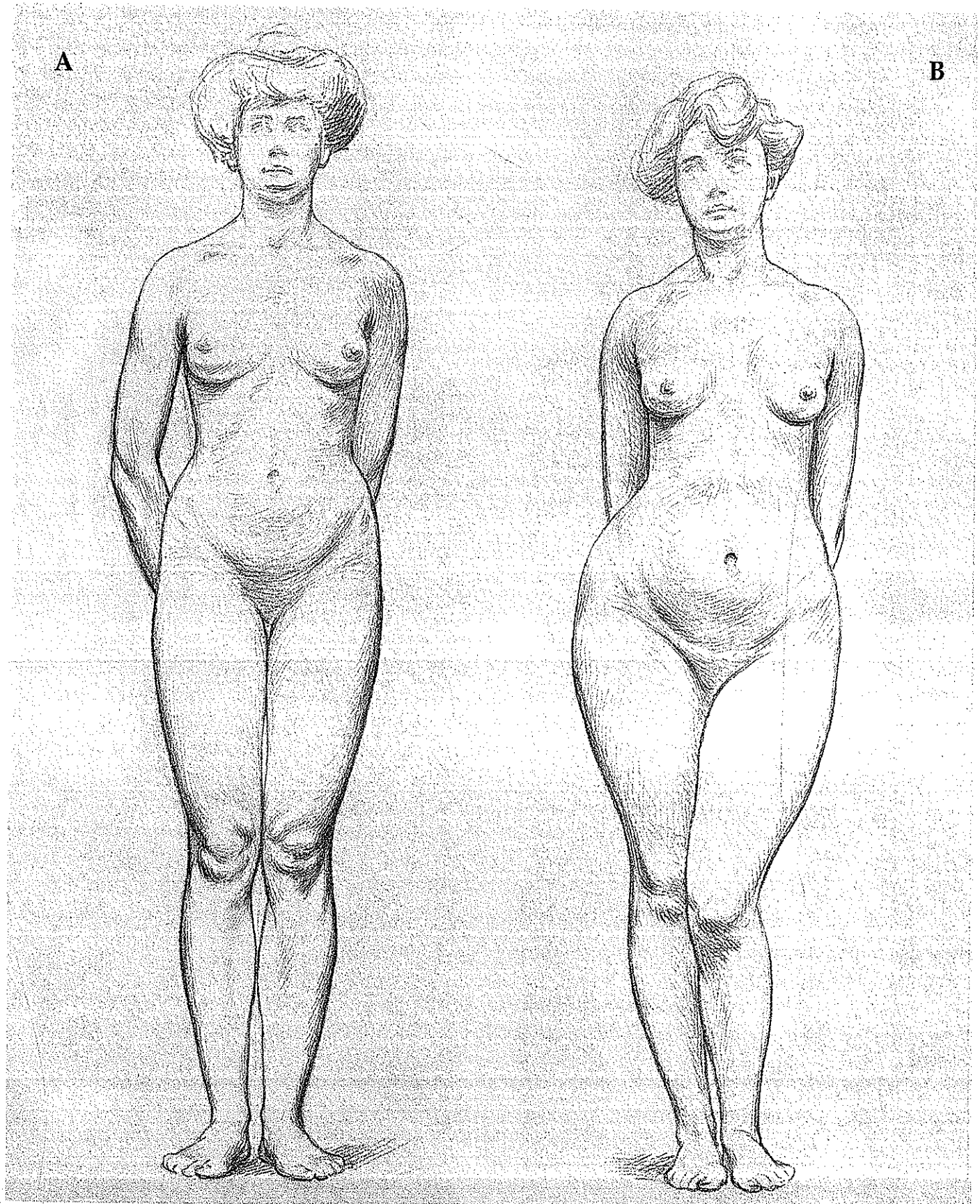

Figure 15: Width of the torso

Examples of a relatively narrow pelvis (A), and a wide pelvis (B). Even in this second case, the width of the hips does not exceed the width of the shoulders.

At the shoulders, as in the hips, one distinguishes two measures of width, or two diameters. One is taken on the skeleton of the torso itself: the bi-acromial diameter at the shoulders, and the bi-iliac diameter at the hips. The other is taken on the living model and includes the roots of the limbs: the bi-humeral diameter at the shoulders and the bi-trochanteral diameter at the hips. (Figure 14) The latter are especially interesting for our purposes, and they yield the following measurements, given in centimeters:

	Men	**Women**
Bi-humeral diameter	39	35
Bi-trochanteral diameter	31	32
Difference	8	3

My measurements indicate a greater difference:

	Men	**Women**
Bi-humeral diameter	42.5	36.85
Bi-trochanteral diameter	32.6	33.31
Difference	9.9	3.54

One sees that the difference between the two diameters is essentially the same in both cases for women, whereas in my measurements, the difference is augmented in men.

If these measurements are scaled relative to a height of 100 units, the results are nearly the same, as the following figures demonstrate:

	Men	**Women**
Bi-humeral diameter	25.4	23.23
Bi-trochanteral diameter	19.5	20.93
Difference	5.9	2.30

On the other hand, if one considers the width of the torso without the limbs, the bi-acromial diameter and bi-iliac external diameter, their relationships are opposite in men and women.

In men, the bi-acromial diameter always exceeds the bi-iliac diameter. In women, conversely, the bi-iliac diameter exceeds the bi-acromial diameter, but the difference is less.

Here are the numbers:

	Men	**Women**
Bi-acromial diameter	32 cm	29 cm
Bi-iliac diameter	28 cm	30 cm
Difference	4 cm	1 cm

If one joins the outermost points of these different diameters with straight lines (Figure 14), one notices that they make trapezoid shapes whose small and large sides are oriented in the same direction for the diameters which contain the roots of the limbs, whereas they are oriented in the opposite direction for the skeletal diameters of the torso.

The width of the torso at the shoulders and at the hips does not grow in proportion to the height. In absolute measures, these diameters are greater in the large sizes than in the petite sizes. But if we scale these measurements in proportion to a height of 100 units, we find that, in the petite sizes, the width of the torso is relatively greater than in the large sizes.

Width of the Torso

		Large sizes	**Petite sizes**
Absolute measures in centimeters:	Shoulders	37.69	36.01
	Hips	34.19	33.43
	Difference	3.50	3.58
Measures scaled to a height of 100 units:	Shoulders	23.04	23.42
	Hips	20.90	21.09
	Difference	2.14	2.33

In women, the two diameters of the torso tend towards equality, and because of the greater accumulation of fat in the hips, they can sometimes achieve the same diameter as the shoulders. However, the inverse relationship, with the hips wider than the shoulders, is never observed.

It is therefore not exactly correct to compare the entire torso to an egg because the large end would be turned in different directions for the two sexes: facing upward for men, and facing downward for women.

In nature, large variations exist in the width of the torso (Figure 15). Subjects whose shoulders are wide yet whose pelvis is of average development are not uncommon. The antique goddesses are all designed based on this model. And youth, which is accompanied by a moderate layer of subcutaneous fat tissue, gives certain young girls the allure of young adolescents. Whereas, in middle age, one observes pronounced deposits of fat which, together with the development of the skeleton, create additional body types with wide and ample pelvises.

After the bones, I should discuss the muscles. But they are exactly the same in women as in men. Generally of lesser volume in the feminine form, they do not play the role that they do in men. Their relief is also moderated in women by the layer of fat that we will discuss in the following chapter. Yet, fat is not the only agent of normal feminine forms; they must result from a harmonious cooperation of fat, muscular, and bony forms.

Therefore, there is no need to describe the musculature of women here. For this information, I refer the reader to the first part of this course, published a decade previously. It nevertheless seems like a good idea to summarize the superficial écorché in two plates (Figures 16 and 17).

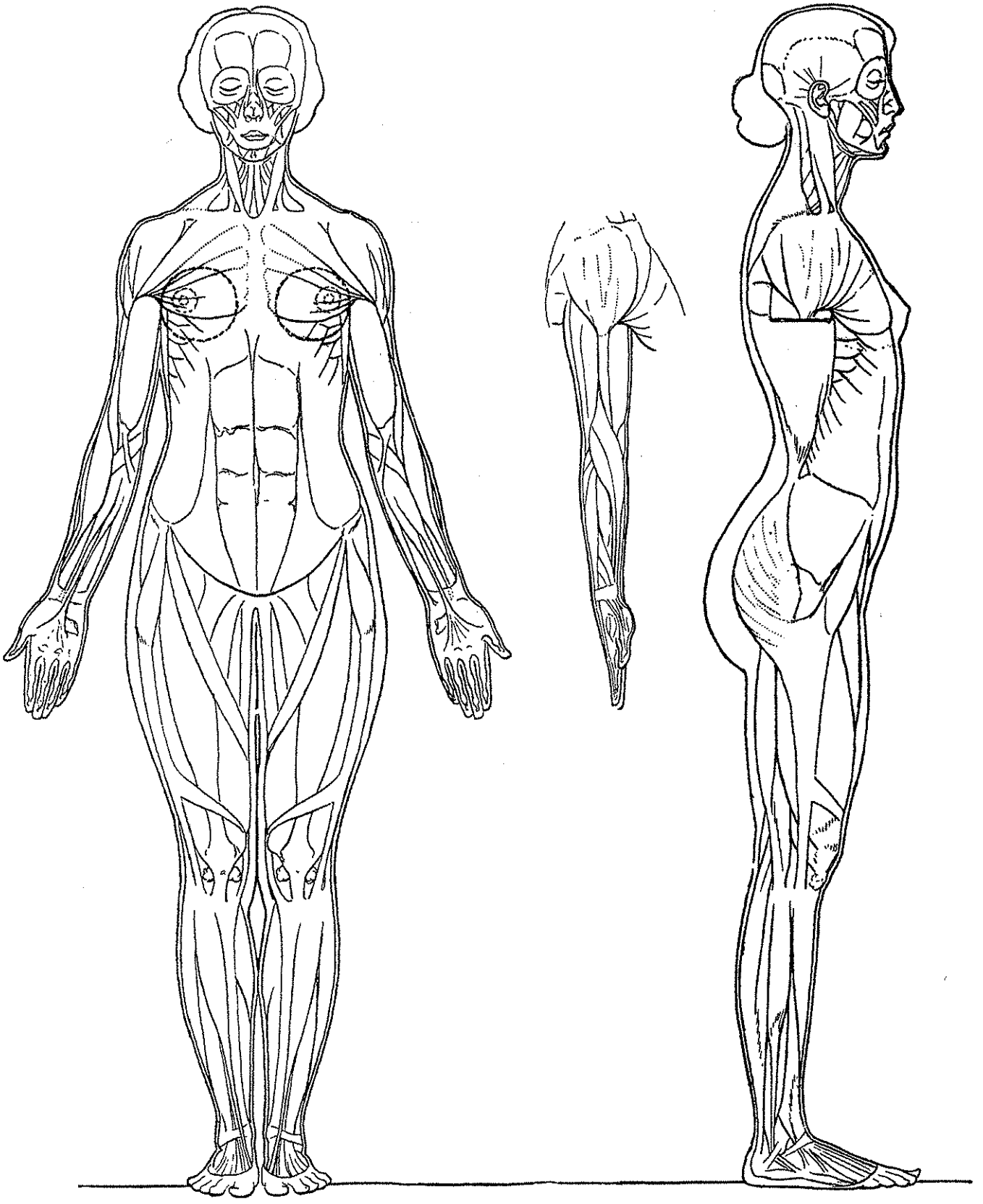

Figure 16: Superficial écorché of a woman, anterior and lateral views

The myology in the woman does not differ from that of the man. The muscular mass is less, but through the volume of the muscles is smaller, their shapes and the locations of their insertions on the skeleton do not change.

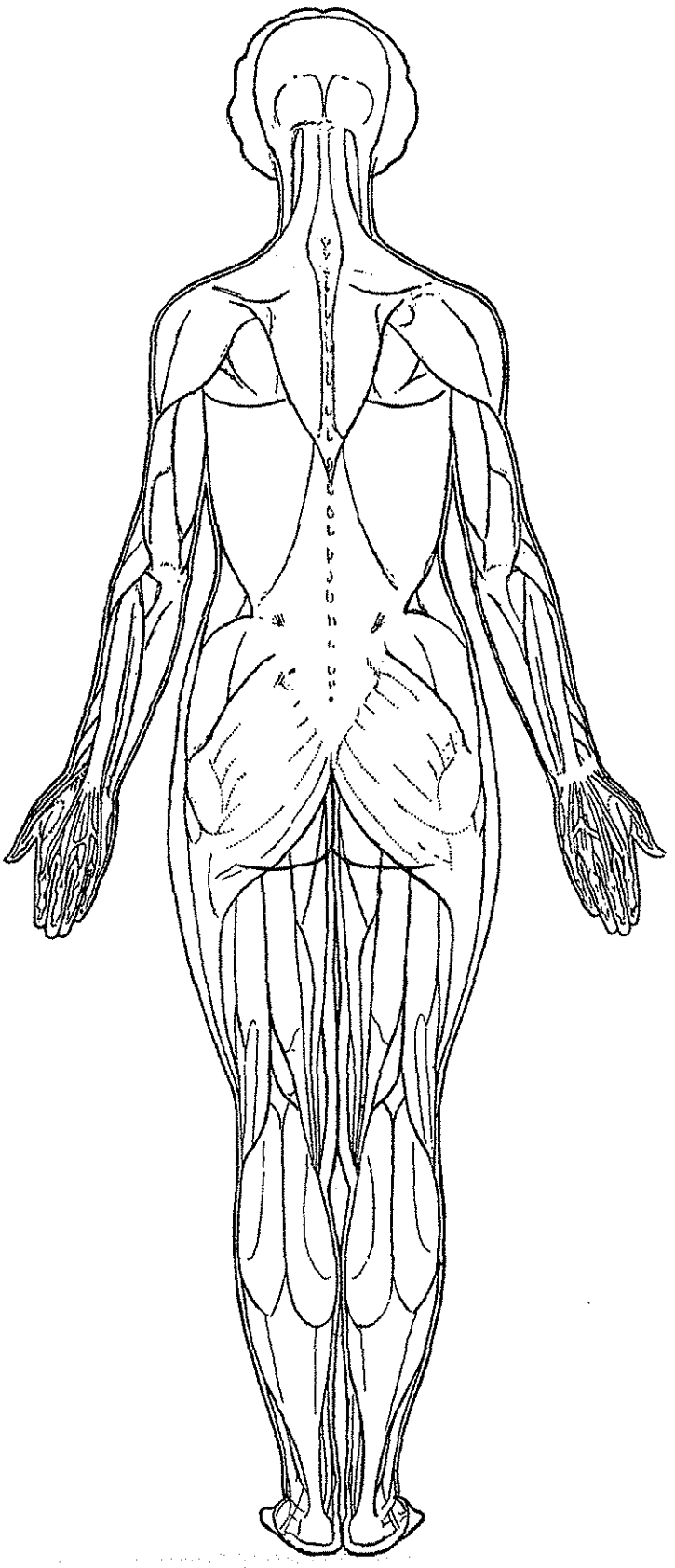

Figure 17: Superficial écorché of a woman, posterior view

II. Characteristics of Fat

It is a common notion that one of the principal morphological differences between men and women consists in the greater abundance of fat in women. This softens the bumps of the écorché, more or less obliterates the bony projections, and, in sum, rounds the surfaces and carves out characteristic folds and dimples in certain places. Though rather simplistic, this notion is certainly true and has persisted among artists until now. But in reality the question is a bit more complex and the ideas that are generally accepted on the role of fat in the feminine conformation need to be reviewed and clarified.

It is true that medical anatomy has systematically neglected the study of adipose tissue. For anatomists poring over the cadaver, fat has always been without interest: cumbersome, and harmful to the clarity and cleanliness of preparations. It is *living anatomy* that shows the considerable part fat has in the morphology of the human body and gives it a legitimate place alongside the skeleton and the muscles.

Living anatomy also demonstrates an important fact: the fatty layer which lines the skin not only varies from one individual to another, thereby creating fat individuals and lean individuals, but also changes in thickness within the same subject in different regions of the body. Thus, the fatty layer becomes the unique cause of special forms that the skeleton and the muscles alone cannot explain.

At the same time, the existence of fat has been demonstrated even on subjects deemed to be lean, and it has a special physiological importance for women. Carrying a reserve of fat is a necessity for everyone, and the fear of obesity should not lead us to make it disappear completely. These reserves of fat accumulate in predictable places. They are well known by farmers and veterinarians, who call them 'handlings,' in animals. In the human species, we call them *fat deposits*. They are, in general, located in the same places in men and in women. The only difference is that, in women, they are much more abundant and become one of the principal secondary sex characteristics.

Therefore, outside of the proportions of the skeleton, fat has the decisive role in the morphological differentiation of the sexes. So in certain pathological cases, its disappearance can diminish or even erase the secondary sex characteristics, especially if the case is accompanied by an open pelvis in a man, or by a closed pelvis in a woman. Excessive weight gain leads to the same result by making the specific deposits of fat disappear into the general accumulation of fat.

Fat affects the body in two different locations. We know that the whole surface of the écorché is covered by a large, continuous aponeurotic envelope that encircles all parts of the body. This *general aponeurosis* is usually destroyed by dissection to reveal the muscle. Fat accumulates both above and below the general aponeurosis.

Below the general aponeurosis, fat fills the voids left between the different organs; it fills up the gaps between muscles, accompanies the blood vessels and nerves, and surrounds the ligaments and muscular insertions. This constitutes the *adipose tissue of interposition*. It is never found in a considerable quantity even in people who are very overweight, and its morphological role is limited.[30]

[30] Nevertheless, the adipose tissue of interposition ought to be mentioned in certain places. It fills the hollow of the armpit, the crease of the groin, and the popliteal space. Above the patellar ligament, it intervenes in the mechanism of articulation of the knee, and during extension of the lower leg, creates two lateral forms that are important to the morphology of the region. Finally, the fatty ball of Bichat fills the void that exists on the skeleton below the zygomatic bone.

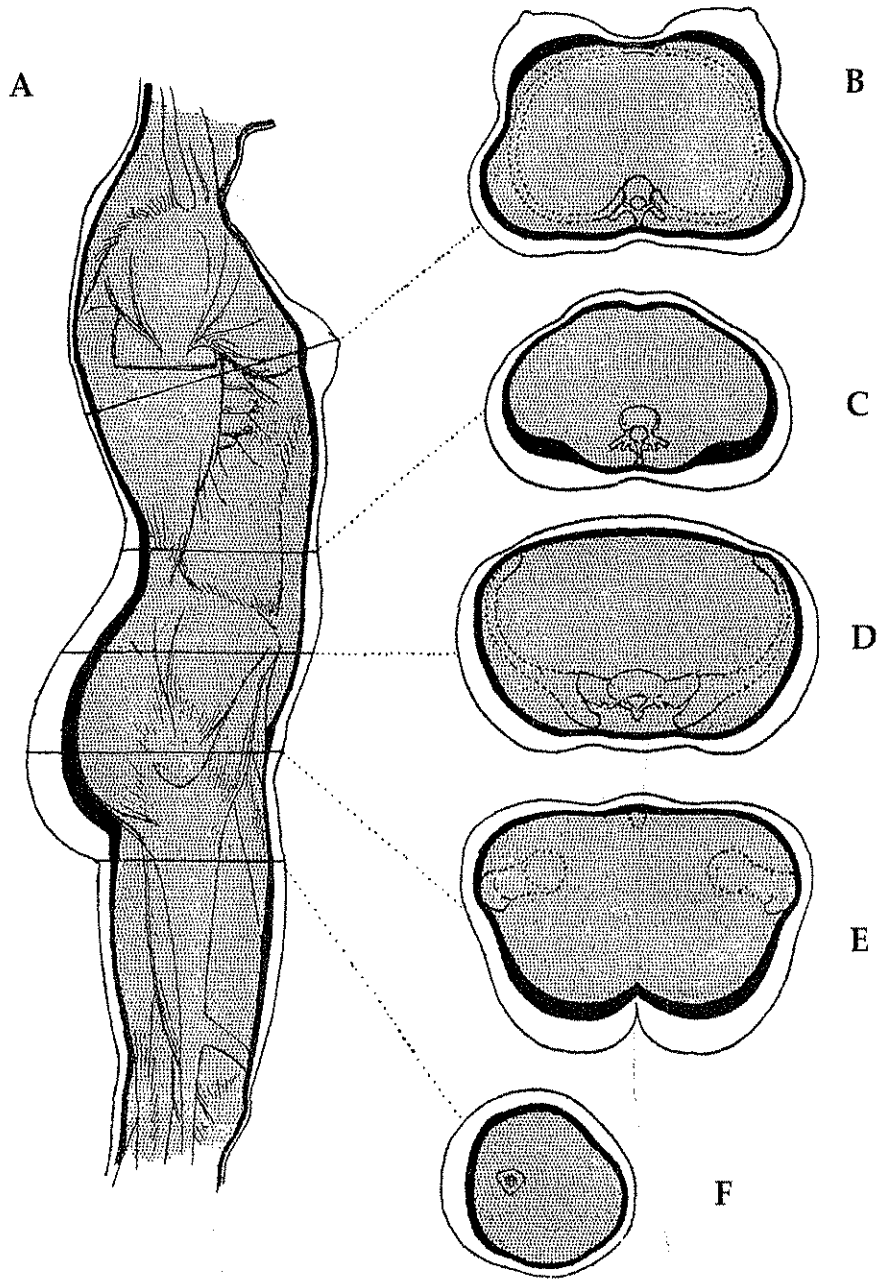

Figure 18: Diagram of fat deposits in men and women.
The varying thickness of the black line indicates the variations in thickness of the panniculus adiposus in a man. The light zone outside of it shows the development of the same fat deposits in a woman.

A. Vertical anterior-posterior plane on which lines of the following horizontal cross-sections are indicated:

B. From the middle of the breasts perpendicularly through the thorax. This section meets the bottom edge of the sternum, the ribcage, the seventh or eighth thoracic vertebra, and passes below the scapula. In back, it cuts the erector spinae muscles and the radiating fascia of the serratus anterior, both covered by the latissimus dorsi. In front, it cuts through the pectoralis major.

C. From the middle of the flank. This section meets the spinal column around the third lumbar vertebra, cuts the rectus abdominus, the three lateral abdominal muscles: external oblique, internal oblique, and transverse abdominus, the lower end of latissimus dorsi and the erector spinae muscles.

D. Through the hip. This section passes from the anterior superior iliac spine to the posterior iliac tuberosity, cuts the sacrum near its base, the gluteus minimus and medius around their middle, the gluteus maximus in its upper part, and the erector spinae muscles.

E. From the top of the symphysis pubis and the great trochanter. This section passes above the ischia, meeting a muscular mass formed by the internal muscles of the thigh in front of the head of the femur: the sartorious, rectus femoris, tensor fascia lata, and cuts the gluteus maximus in back.

F. From the upper part of the thigh, below the gluteus maximus.

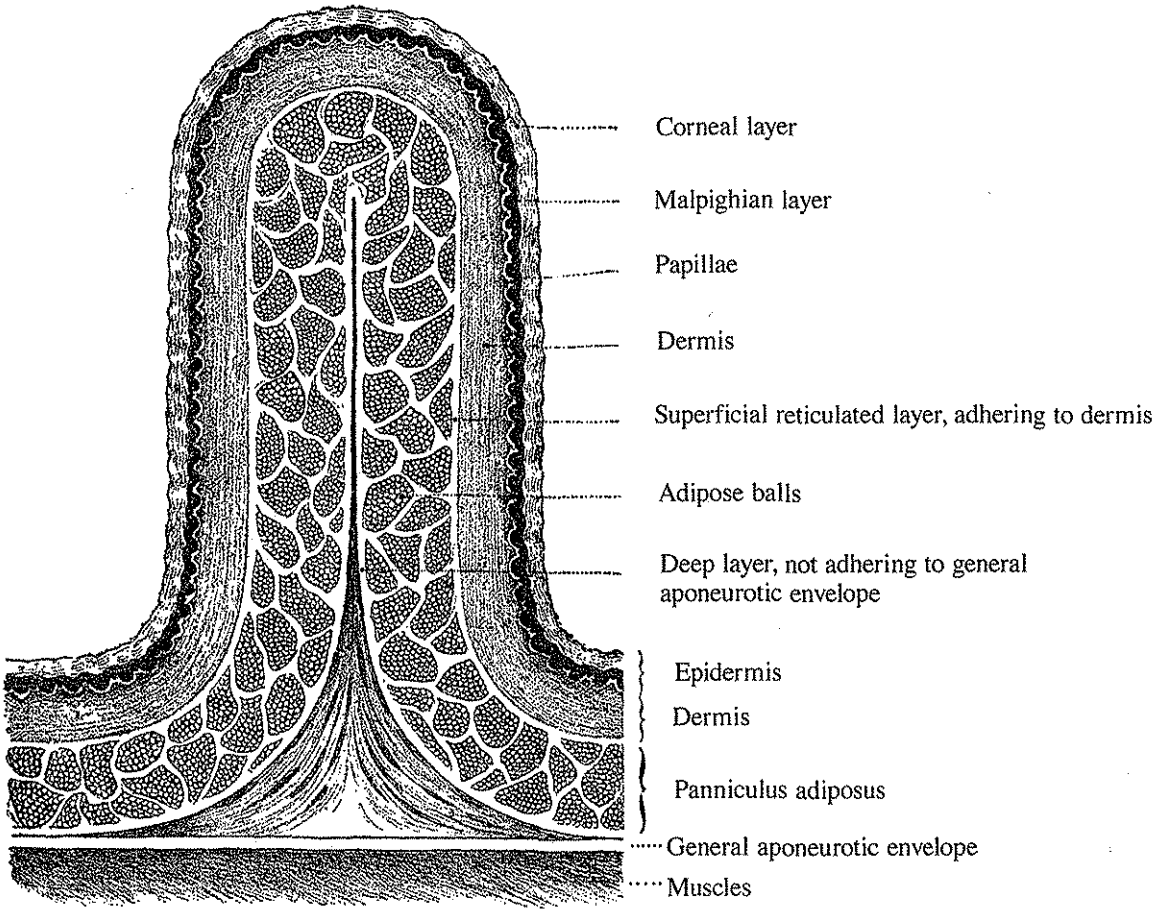

Figure 19: Vertical cut of a fold of skin, from a wall chart drawn by Dr. Chicotot.

It is not the same for the adipose tissue located above the general aponeurotic envelope and directly below the skin, to which the skin is intimately connected. This tissue takes the name *panniculus adiposus*, and its morphological role is very important. Because of this, the skin is not directly applied on top of the écorché. Localizations of fat develop within the panniculus adiposus which add unique forms to the body. These forms deserve a place alongside those of bony and muscular origin under the name *fat deposits.*

It is important to clarify these forms. Research has been conducted on living subjects towards this goal, and the special anatomical disposition of the fatty layer (Figure 19) has made it easy by permitting measurement of its thickness in various regions through a rapid and simple process.

The *panniculus adiposus* is formed in three layers. First is a superficial layer made of a reticulated tissue that is intimately united with the skin. Second is a deep layer, a kind of cellular sheet that slides easily over the general aponeurotic envelope. Finally, between the two and in variable quantity, we find fat in the form of balls, kept in boxes by cellular partitions.

It follows from this disposition that if one makes a fold in the skin, one forcibly grips with it the panniculus adiposus, which slides over the deeper parts. Thus, in a fold of skin there is twice the thickness of the skin itself and twice the thickness of the panniculus adiposus. Since the thickness of the skin has a nearly constant value that does

not exceed 1 or 2 millimeters, the variable thickness of different skin folds corresponds to the differences in thickness of the panniculus adiposus.

Therefore, it suffices to measure the thickness of skin folds at different places on the body to appreciate the variations in the panniculus adiposus within the same individual. A pair of specially constructed calipers facilitated this research. With a bit of practice, I achieved sufficient precision at measuring folds in the skin created simply by pinching it with the fingers.

In the torso, the locations of fat deposits are common to both sexes. They exist principally in the mammary region, the abdomen, the flank, and the buttocks (Figure 18). At the limits of the torso and on the limbs, they are more often found in the feminine sex (Figure 24).

I will say a word on the principal fat deposits and classify them in order of importance.

1. Fat deposit in the buttock

The volume and shape of this region are not due, as is generally thought, to the gluteus maximus muscle, large though it may be. Fat plays an important role here. The firm and sculpted buttocks of adolescence are due to a dense and resistant fatty tissue (Figure 21). The flattened buttocks of old age are due in large part to the melting and disappearance of the same tissue. It could be noted, moreover, that even in individuals who present considerable muscular development like athletes and gymnasts, whose panniculus adiposus is as diminished as possible, the buttock produces only a slight projection. It is sometimes even flattened and, except when the muscle contracts, it has a soft and fluid consistency, which buttocks that are termed 'fatty' do not have to the same degree.

To the contrary, in women, who are usually less muscular than men, the region of the buttocks takes on a remarkable development due almost entirely to fat. The buttocks owe their shape to the fat deposit in this region, which is the consequence of a special anatomical disposition that will be discussed later. It remains clearly delineated from below by the gluteal fold. Moreover, the width of the woman's pelvis is augmented again by this fat deposit, which adds to its exceptional importance, to the point of making it one of the first elements of sexual differentiation.

In no other part of the body is fat so abundant.

2. Fat pad of the flank

After the buttock, the posterior part of the flank holds second place in the list of fat deposits. Fat is always encountered in this region at the boundary of the kidneys. Even in lean people, a veritable fat pad exists which not only fills a normal void on the *écorché*, but makes a very clear projection whose importance has been overlooked. In subjects who are beginning to gain weight, the fat pad of the flank rapidly takes on a remarkable development. But the fat accumulated in this region is most developed in women.

This fat deposit extends to the upper limits of the region, which is to say, to the superior furrow of the flank that always separates it from the subscapular region, which is also often invaded by fat. In this case, an oblique furrow is formed here that may be deep or shallow, and is accentuated on the side of the standing leg in *contraposto* (Figure 21, E). Below, to the contrary, the fat pad of the flank lacks precise boundaries in women, and merges with the fatty tissue of the superior part of the buttock, so much that these two regions, the buttock and the flank, seem to blend together. Thus, the height of the buttock appears to extend until the waist.

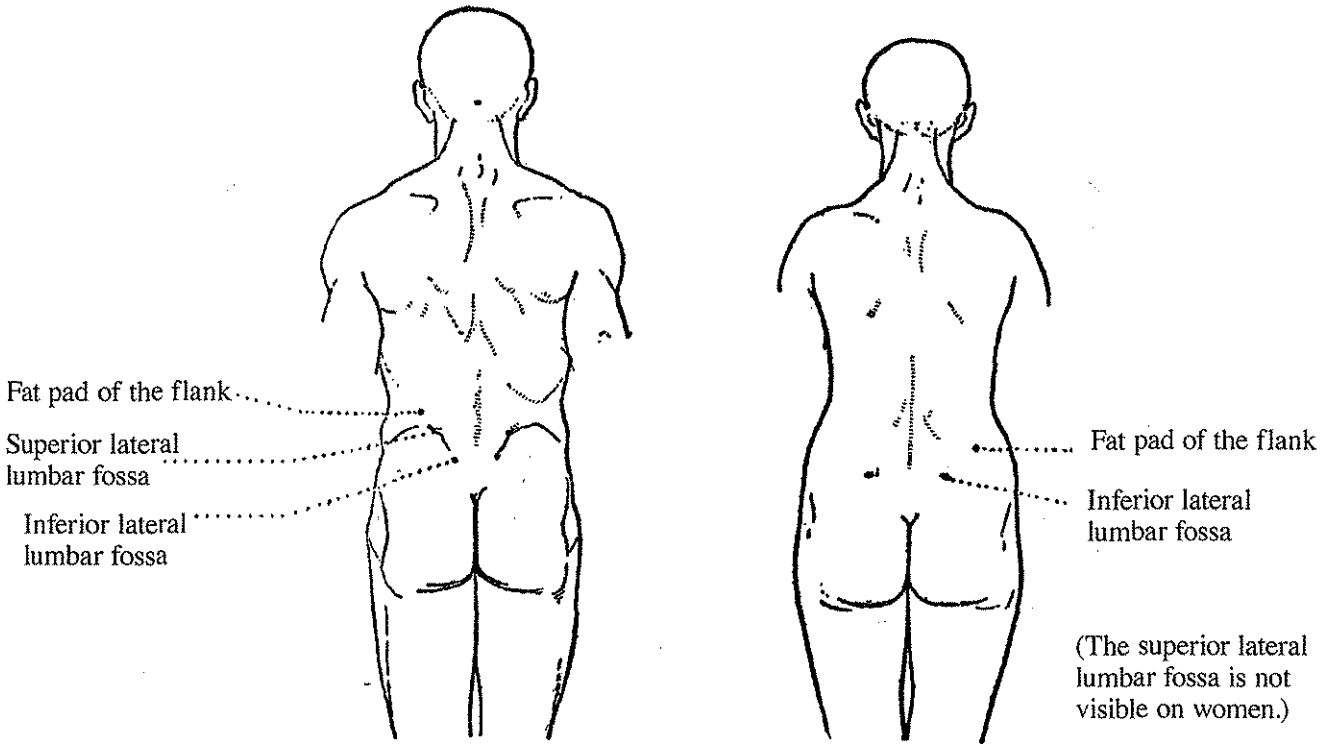

Figure 20: Fat pad of the flank in men and women.

Fat in this region makes the superior lateral lumbar fossa disappear, which corresponds to the corner of the iliac crest just above the sacrum. This fossa is constant in men. In women, the inferior lateral lumbar fossa, which corresponds to the iliac tuberosity, persists and by its isolation even gains in importance (Figure 20).

In certain subjects and in the elderly in particular, it sometimes happens that the surface of the flank is divided by an oblique furrow which separates its muscular anterior part from the fat pad situated in back (Figure 21, G). This disposition is accentuated during backward extension of the torso.

3. Abdominal fat deposit

The skin of the abdomen is lined by a fatty layer which is always less abundant than in the two preceding regions, contrary to the conventional wisdom which presumes that the abdominal region is the principal site of weight gain. It is nonetheless true that the thickness of the abdominal fat prevails over that of the regions immediately adjacent to it, a difference that grows rapidly as soon as the belly takes on a bit of weight.

In women, the fat that accumulates in this region gives it a characteristic aspect. It tends to be localized around the navel, between the waist and the curved fold situated a few fingers' width from the pubis. The navel finds itself thus placed at the back of a sort of crater whose depth varies with the abundance of fat in the area. The pattern of the rectus abdominus in the abdomen is always well defined in a muscular man and more attenuated in women because of the superposition of abdominal fat, but it can still be identified in many beautiful models. Let us add that, in women, fat is generally more abundant in the region below the navel than above, contrary to what is observed in men (Figure 18).

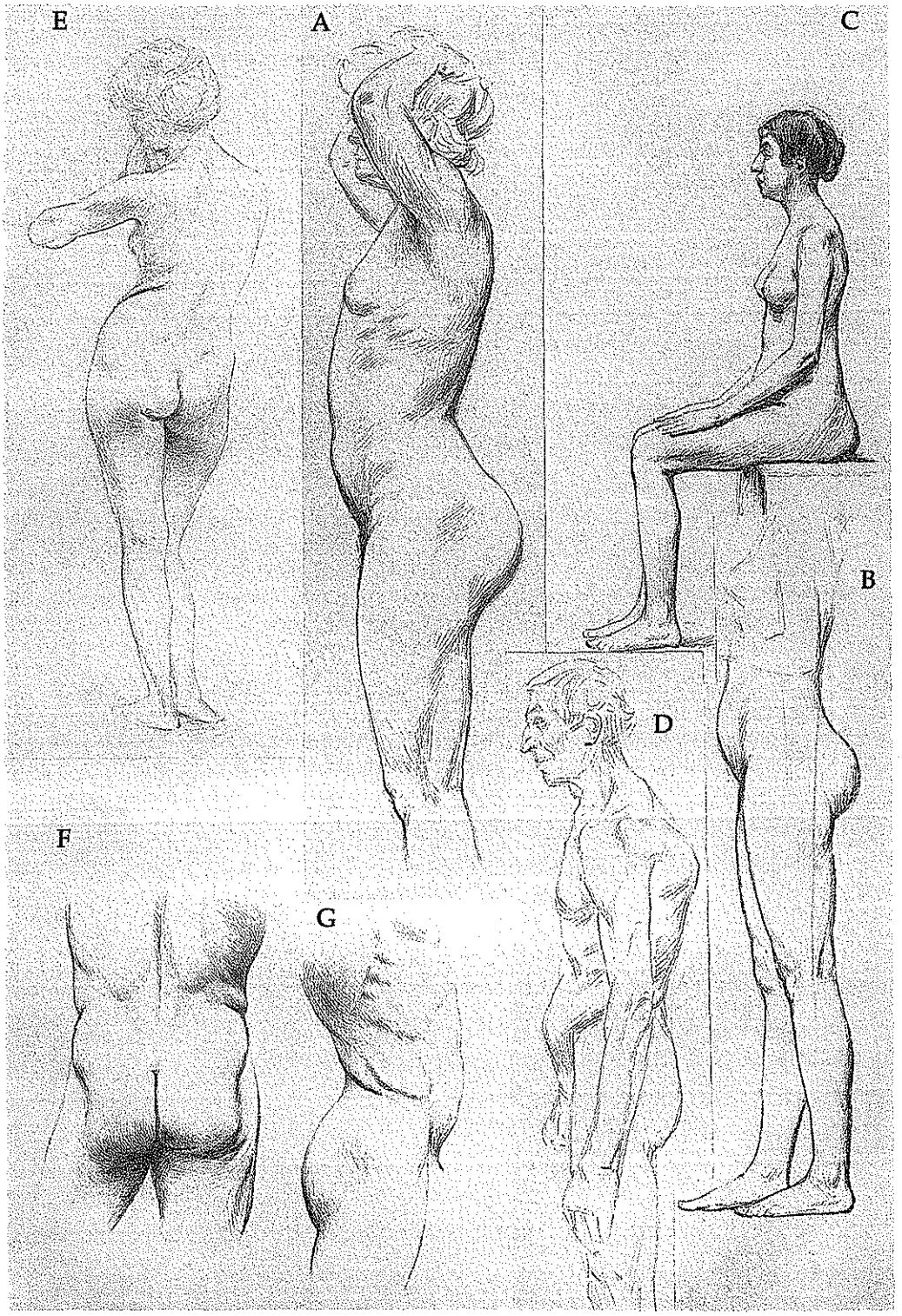

Figure 21: Examples of fat deposits in the buttocks and flanks.

A. & B. Full forms in the buttocks of young models

C. The same model from B, seated

D. Flattened buttocks in an old person

E. Sketch showing the flank merge with the buttock in a young subject; it is accentuated by a deep crease at the top, which deepens in contraposto.

F. Fat pad of the flank in a man who is slightly heavy

G. Fat pad of the flank distinct from the muscular projection of external oblique, seen in certain subjects, and accentuated by backward extension of the torso.

4. Fat deposit of the mammary region

Even in the man's rudimentary mammary, fat tissue plays a significant role in its shape. The fat tissue increases in importance from the top of the region to the bottom, to achieve its greatest thickness in the inferior part. The relief of the whole area is not only due to the muscle of pectoralis major, but, like in the buttock, fat tissue also plays a part here. It sometimes happens that this fat deposit is so defined around the nipple that it causes a special form; a sort of rudimentary breast, often well observed by artists of antiquity and the Renaissance.

In women, it is the fat, much more than the mammary gland itself, which determines the volume of the breasts, their shape: hemispheric or conic, and also their degree of sagging when the fat disappears.

5. Cervico-dorsal fat deposit

At the boundary of the neck and the back, at the oval aponeurosis of the trapezius and covering the 7th cervical vertebra, there often exists a fat deposit as large as an actual tumor in the woman of mature age. But this adipose formation is not the exclusive domain of older women who gain a bit of weight at the back of the neck. It is also found on young girls (Figure 22). Its constancy is not absolute. Where it exists, its contours are clearly defined and should not be confused with the consistent thickening and the diffuse quality of the panniculus adiopsus that lines the skin at the back of the neck.

6. Pubic fat deposit

One observes an accumulation of fat that covers the symphysis pubis at the lower part of the front side of the torso, and is especially prominent in women. Triangular in shape, it is bordered from above by the horizontal crease above the pubis, and on the sides by the oblique creases of the thighs. It is principally this deposit that creates the projection of the whole region.

7. Posterior deltoid fat deposit

At the posterior, superior part of the woman's arm, in back of the deltoid's insertion, a fat deposit accumulates that may be more or less voluminous but is always very characteristic (Figure 24). It is the cause of the widening of the root of the arm in the anterior-posterior direction. It appears even more clearly when the arm is extended backwards, and there are certain poses that emphasize it (Figure 24: C, D). Its contours are quite clear, and in muscular women, the form of the triceps appears below it in the lower half of the arm.

8. Subtrochanteric fat deposit

This fat deposit plays an important role in the feminine form. It consists of a mass of fat that is sometimes very voluminous and is situated on the superior and lateral part of the thigh (Figure 24: E, F, G). The resulting projection begins at the great trochanter and rapidly attains its maximum thickness, then diminishes gradually to stop around the lower third of the thigh. Below it, one distinguishes the lateral furrow of the thigh, whose upper portion may be filled by this fat deposit. In front and in back, its limits are much less clear. In front, it merges with the fat tissue of the anterior side of the thigh, and in back, with that of the buttock.

Where fat is abundant, one often observes multiple depressions of varying depths on the surface of the skin, which make these areas appear like padded upholstery from far away, though the regularity of the design is missing. The comparison is applicable, however, because of the anatomical mechanism that is the cause of this effect. Inflexible fibrous tracts connect the deep level of the skin to the general aponeurotic envelope at the site of these depressions. The fat projects in the intervals between, so the analogy with the mechanism of upholstery is quite appropriate.

Figure 22: Cervico-dorsal fat deposit in a young girl of nineteen years. *This form is observed more often and tends to be more developed in older women, although it may be seen in young women as well.*

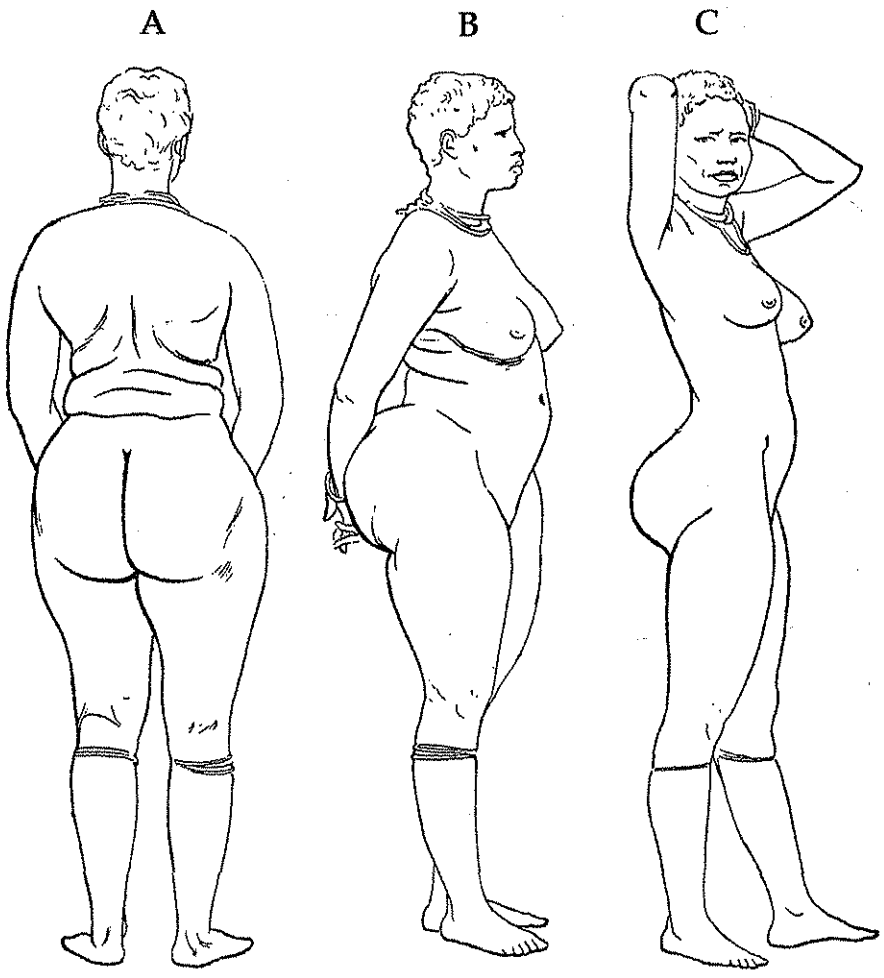

Figure 23: Steatopygia in Khoikhoi women
A., B. The same woman seen from behind and in profile C. A younger woman seen in profile

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The fat deposits of the buttock and thigh can take an extraordinary and gigantic development in some people (Figure 23). The steatopygia of women of the San and Khoikhoi people is simply this. The volume of these fat deposits alone is different, while European women show all degrees of moderation in this respect. Nevertheless, a defining characteristic of real steatopygia is that, regardless of the quantity of fat that accumulates in the buttock, even to the point of making an actual promontory that projects from this area like that observed in some children, the fat deposit stays exactly confined to the region. It does not merge with the fat pad of the flank, as it does in some Europeans. The steatopygia in women of the San and Khoikhoi peoples is always separated from the fat deposit of the flank by a deep furrow.

9. Fat distribution on the limbs

Generally speaking, the thickness of the subcutaneous panniculus adiposus diminishes from the roots of the limbs to the extremities.

In the upper limb, this diminution in fat along the posterior surface is remarkably consistent and did not present a single exception in this regard on the twenty subjects examined. The superior part of the upper arm, at the level of

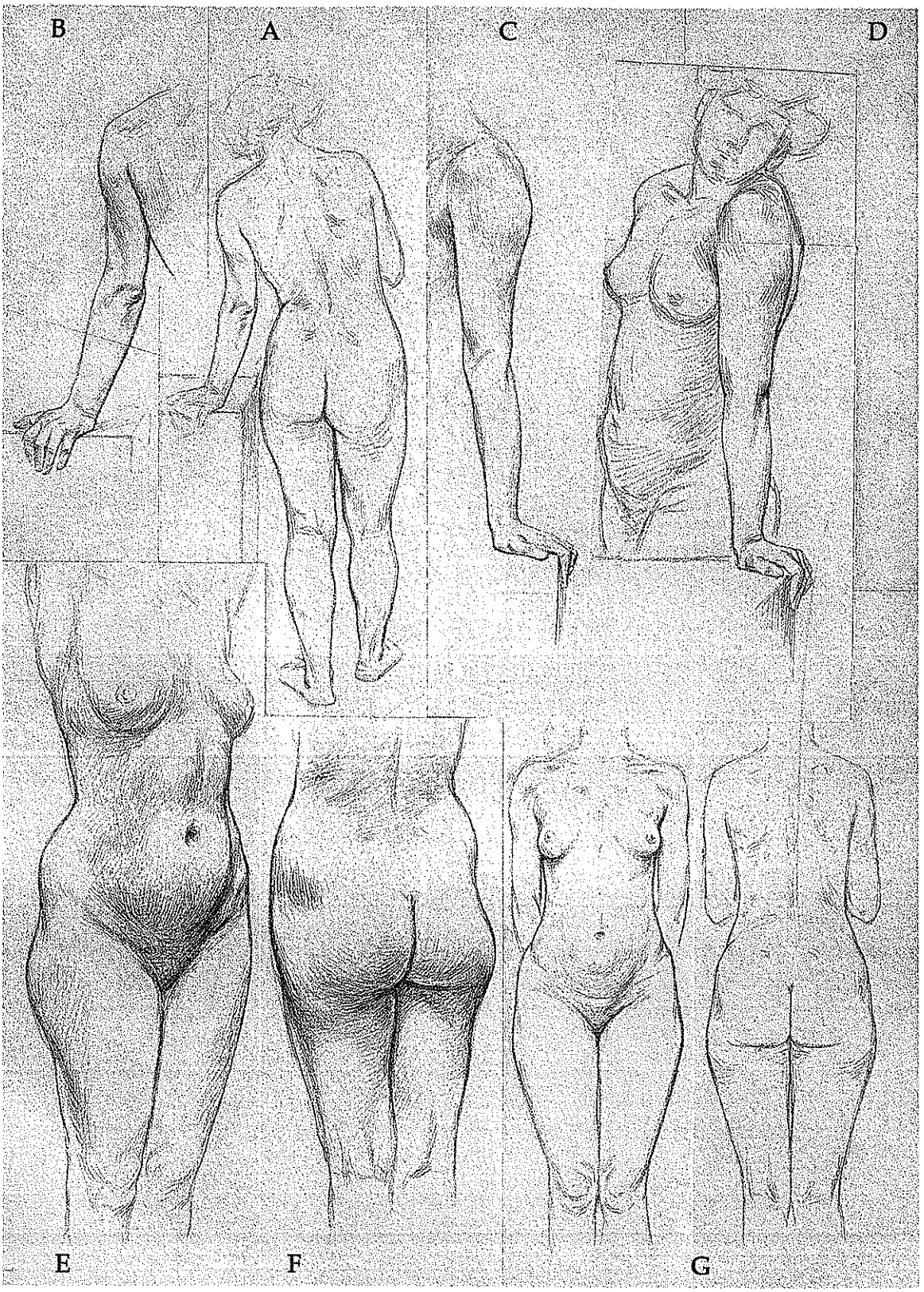

Figure 24: Fat deposits at the roots of the limbs

A, B, C. Post deltoid fat deposit in the same subject seen from various views. The extension of the arm backwards accentuates the relief of this fat deposit.

D. Sketch made from another model.

E, F. Subtrochanteric fat deposit seen from the front and back in an older model.

G. The same fat deposit on a younger model who resembles the 'false lean' type.

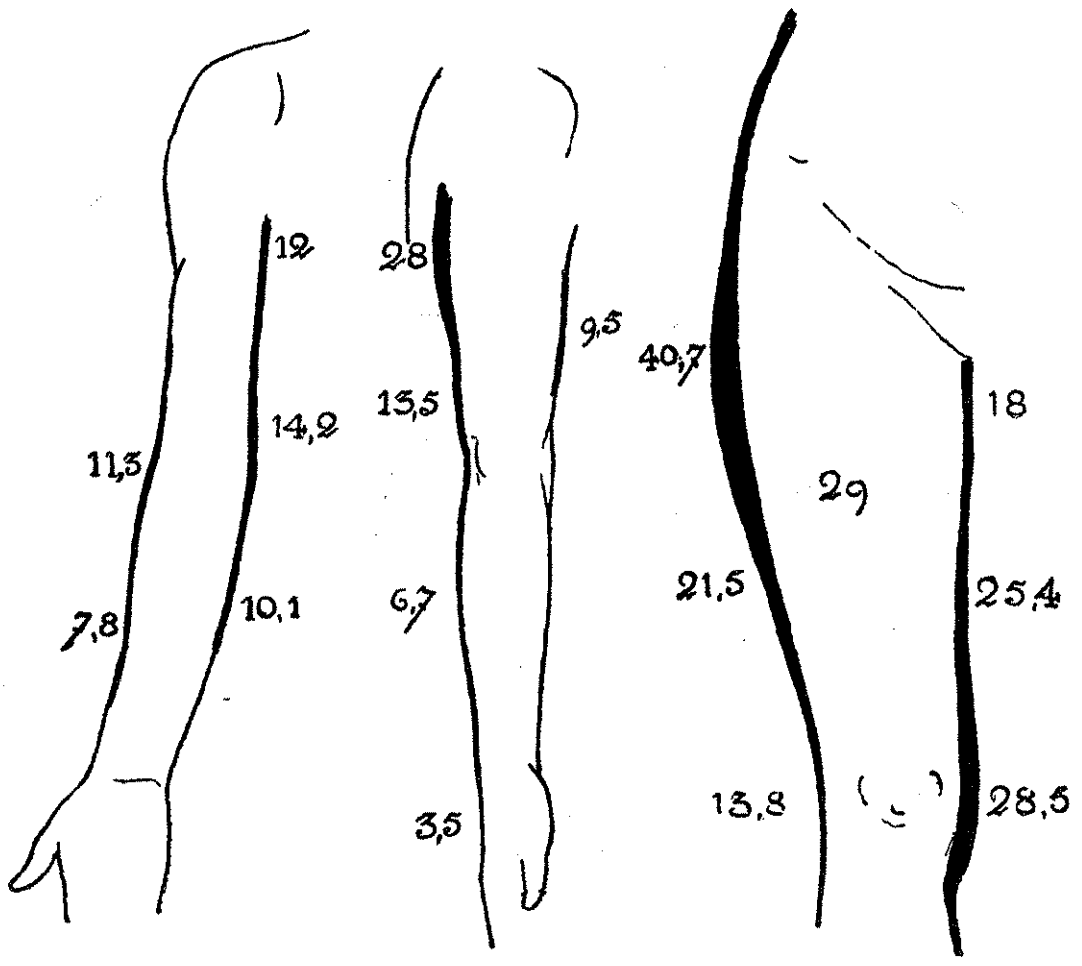

Figure 25: Thickness of the panniculus adiposus in the woman's arm and thigh.
The numbers indicate this thickness in millimeters, approximated by the thickness of the black line.

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the posterior deltoid fat deposit, is naturally the thickest. Next comes the medial side, in the region of the elbow, with two exceptions out of 20. These results are summarized in Figure 25, represented by the numbers indicated along the profiles.

- In the upper arm, the maximum thickness of fatty tissue is in back. The minimum thickness is in front, at the level of the biceps.
- At the elbow, the lesser thickness is on the lateral side.
- In the forearm, the thickness is greater on the medial side than the lateral side, and greater on the lateral side than at the posterior.
- Finally, at the back of the hand, the fat almost entirely disappears.

In the lower limb, the accumulation of fat is noticeably more abundant than it is in the upper limb. In the thigh, it produces a curious opposition between the medial and lateral sides. On the outside, the fat layer, which is represented by the subtrochanteral mass, diminishes bit by bit as it approaches the knee. Inside, it is the reverse.

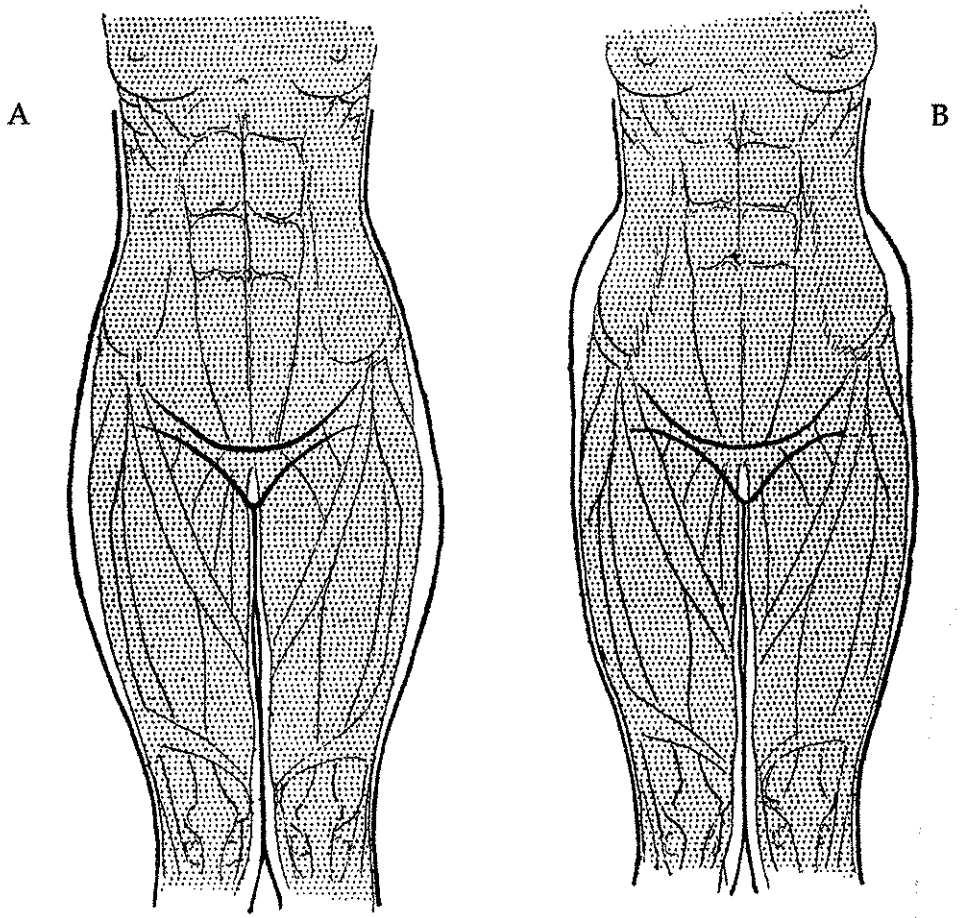

Figure 26: Variations on the profile of the hips and thighs with the predominance of the subtrochanteric fat deposit (A), or the predominance of the deposit of the hips (B). *In the two figures, the silhouette of the écorché is the same.*

Slight at the root of the limb, the fatty tissue increases in thickness as it descends, acquiring an importance that is often considerable at the medial surface of the knee where it plays a role in the morphology of the region. I will not describe the fatty forms of the anterior part of the joint here, as they are part of the fatty tissue of interposition.

The forward curvature of the front of the thigh observed on certain women is due to an abundant panniculus adiposus, which is always somewhat thinner at the medial and lateral sides than elsewhere in this region.

The specialized fat deposits that are so characteristic of the feminine sex have, so to speak, an independent existence from the rest of the adipose tissue. They do not exist in children, and do not develop until the time of puberty, when they take their place among the secondary sex characteristics for their important part in the realization of the feminine type. Various causes of weight loss can make the panniculus adiposus melt away without achieving the secondary sex characteristics. Even in the normal state, this rather clear separation between the two fat formations can exist, and one sometimes sees abundant fat deposits on subjects with no fat anywhere else. This disposition creates a well-known type, which we designate by the term 'false lean.'

Generally, special fat formations develop in a rather abundant panniculus adiposus. These deposits certainly do not attain an equal development in all women. Many individual variations exist in this regard. In certain cases, these

moderately developed fat deposits melt themselves with imprecise limits into the neighboring fat, thus creating a particularly harmonious type that one could identify with the antique Venus. In other cases, a more developed fat deposit acquires a greater independence and leads to more varied forms, which are sometimes particularly striking. One sees them in works of the Renaissance, especially in German Renaissance artists. The fusion of fat deposits into a dense and resistant panniculus adiposus results in this full form, simple and powerful, which Raphael delighted to represent, and of which the Farnese frescoes offer magnificent examples. In the feminine figures of Michelangelo, muscle asserts itself more than fat.

Outside of these cases where the various fat deposits seem to obey the same law throughout the whole body, there are numerous others where the inequality of their development dominates the scene and leads to an infinite number of morphological variations.

I will point out two examples relative to the conformation of the hips and thighs of a subject viewed from the front (Figure 26). If a slight fat deposit on the hips coincides with a large development of the subtrochanteric deposit, the symmetrical curves that embrace the lower part of the feminine torso represent the shape of an amphora. But if it is the reverse, and an abundant accumulation of fat in the hips coincides with a complete absence of the subtrochanteric deposit, the shape of the amphora disappears and begins to resemble that of a less harmonious vessel, like a top.

It is thus that the woman, although made from the same organs and tissues as the man: the same bones, muscles, vessels, and nerves; possesses infinitely more varied forms. The principal cause of this variety, which makes the feminine form so undulating, diverse, and so difficult to define, rests precisely in the unlimited variations of the fatty tissue. It is almost fluid, and does not present itself in distinct shapes like the bones and muscles. Its accumulation constitutes the fat deposits.[31]

[31] Text and image removed to Appendix III.

III. CHARACTERISTICS OF SKIN

A. THE SKIN

The skin is a continuous membranous envelope, resistant and elastic, that extends over the entire surface of the body. It is continuous at every point, and at the natural orifices it merges without interruption into the mucous membranes. Its resistance is considerable; its elasticity permits it to mold itself, so to speak, over the deep parts like a bathing suit does to the surface of the body. In movements, it accompanies and exactly follows the displacement of the deep parts, allowing it to stretch when necessary, and then return without difficulty to its former shape. In youth this elasticity is perfect, but it tends to diminish with the progress of the years. In old age, this weakening of the skin's elasticity is the cause of the cutaneous folds known as wrinkles.

The skin's thickness varies in different regions of the body, though it is generally between 0.5 and 2 millimeters. The skin is 3 millimeters thick at the palms of the hands and the soles of the feet, and can reach up to 4 millimeters in the nuchal region.

The skin is lined, as we have seen in the preceding chapter, with a fatty layer that adheres intimately to its deep surface and whose variable thickness gives rise to the fat deposits that we have mentioned. Skin and fat, intimately united, slide over the deep parts, which permits this coating to adapt itself exactly to the displacement of deep organs, as well as to slide and move away, so to speak, under the pressure or shock of external agents.

The skin is composed of two parts: a deep part, the *dermis*, and a superficial part, the *epidermis* (Figure 19).

The dermis alone receives the vessels and nerves that penetrate up to its most superficial part in a multitude of little bumps called papilla, which bristle its surface. Its deep layer, or reticular region, consists of filaments inter-crossed in all directions that link the skin to the adjacent fatty layer. The skin owes its resistance, its elasticity, and also its sensitivity to the dermis.

The epidermis, which covers the dermis, is composed only of epithelial cells, arranged in two layers. The deep layer receives the papilla from the dermis, whose trace disappears at the cutaneous surface, with the exception, however, of the palms of the hands and the soles of the feet where fine ridges delineate the papillary rows.

This deep layer of the epidermis, in direct contact with the papilla, is soft and moist. It takes the name *mucous layer* or *Malpighian layer*, and is the site of an accumulation of pigment that occurs mainly in cylindrical cells that are applied directly on the dermis, which is the sole cause of the color of the skin. People with dark skin owe their coloration only to a more considerable quantity of pigment deposited in the deep layer of the epidermis.

In the superficial layer, or *corneal layer*, the cells flatten themselves more and more as they approach the surface, and gradually dry out. The cells in the most superficial of these strips, henceforth unfit for their animal function, detach themselves from the epidermis and, like dead elements, fall into the exterior realm.

Numerous folds run through the surface of the skin.[32] Depending on their cause, one distinguishes the following types:

1. *Folds of adherence*, which is to say, those caused by the presence of fibrous tracts that unite the skin with the deeper parts, such as the furrow of the median line of the body in front and back, the crease of the buttock, the crease of the groin, the fold of the armpit, and the flexion folds of the limbs.
2. *Folds of movement*, for example, created by the flexion of the neck, the torso, and the extension of the limbs.
3. *Folds of expression*: muscular creases created by the contraction of facial muscles
4. *Wrinkles of old age*: creases created by the loss of elasticity of the skin
5. Finally, the *fine structural creases* on which we focus most specifically, because they influence the appearance of the skin.

These structural folds are more or less microscopic, and are of two varieties. On the surfaces of the hands and feet we find the *papillary folds*, which reproduce the design of the rows of dermal papilla, which we have already mentioned. On the rest of the body, small folds of variable form are designated under the terms *hatched* or *diamond-shape wrinkles*. They were called *wrinkles of elasticity* by Gerdy, who made a detailed and very accurate description of them.[33]

"The wrinkles of elasticity," said Gerdy, "are produced by the elasticity of the skin itself; so they change considerably by the tension which makes the skin feel. They play a large role in the reflections they impart on the light. These wrinkles are extremely fine; on nearly the entire surface of the body, one does not perceive them except with a magnifying glass. In looking at them closely on the wrist and the hand, one could study them with the naked eye to a certain point."

"Of these wrinkles, some appear as a series of quadrilaterals in diamond shapes; others take the shape of lines that are roughly parallel, which are connected by intermediate oblique or transversal wrinkles that are less visible; still others are irregular. The first type, which are roughly quadrilateral, are observed at the fold of the elbow, around the wrist, and on the back of the hand. The second type, which are linear, are seen in the same places, mixed with the previous. One also distinguishes them on the bellies of the fingers. The third type exists on almost all of the rest of the body, and are only seen well with the magnifying glass. They form irregular networks."

"When the skin is pulled in one direction, these various wrinkles elongate immediately, and as soon as the skin is pulled in the opposite direction, they extend again, precisely like the mesh of a net. The quadrilateral and linear wrinkles, or at least those of them that are the most visible, are arranged in an opposite direction to the large movements that they follow. Thus, they are transversal around the wrist and on the back of the hand, longitudinal between the heads of the metacarpals, and transverse at the backs of the fingers. Similarly, they follow multiple directions in the places where the skin needs to spread itself in several directions at once; for example, between the thumb and the index finger, and at the heads of the metacarpal bones."

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[32] Whether it refers to fabric or skin, the word *fold* is takes on two different meanings: sometimes it means projections, long or short, of double folds made by the backing of two thicknesses of the skin; sometimes it refers to single linear depressions that, according to their width, take the shape of creases or furrows. To sum up, there are *inward folds* or creases and *projecting folds*. The anatomy of forms deals especially with the inward folds. They are also the most numerous, such as the crease of the groin, the crease of the elbow, etc.

[33] Gerdy, *Anatomie des formes extérieures du corps humain*, 1829, p. 307.

"It follows from this that by the direction of these structural folds alone, one can infer the movements of the part where one observes them, as they seem designed to lend themselves freely to certain movements. They serve also for the amplification of the skin as the body gains weight. This appears to be the function of the longitudinal wrinkles at the bellies of the fingers. The irregular wrinkles have no particular habit; it is probably because they have to serve in the deployment of the skin in all directions that they are not more pronounced in one direction than in another, like regular wrinkles. These, in effect, only differ from the others by their character. They form networks like irregular wrinkles, but networks in which the links are more pronounced in one direction than the other. These wrinkles, in yielding and unfolding in overweight subjects, give the skin a unified and smooth surface, where light is reflected with a flash. In bringing the dermis together and overlapping it in the cold, they make the skin protrude in intervals and give rise to goose bumps."

Aside from this description of goose bumps, whose cause is something else as we will see farther on, there is nothing to alter in Gerdy's description.

The presence of this tangled network of small wrinkles at the surface of the skin, or its absence, determines the skin's appearance as matte or shiny.

The coloration of the skin not only varies with race, following the ancient classification of the Caucasian race, the Asian race, and the Negro race; it also varies with individuals, and in those with fair skin, these variations are very sensitive. One distinguishes, in effect, some skin that is very white, some that is more or less rosy, yellowish skin, or brown skin. On the same individual, the tint of the skin is not the same everywhere, and it becomes almost amber colored where it is more supported on certain parts of the body.

This local color of the skin depends on the nature and the quantity of the grains of pigment that are contained in the cells of the deepest layer of the epidermis.

But, there are other factors to skin coloration in addition to the previous one. First is the greater or lesser richness of the circulation of blood, whose importance is demonstrated by the pallor of syncope or by the redness that sometimes rises to the face. Circulation is a variable element between individuals and between different regions of the body on the same individual, according to the sentiments that animate it.

In addition, the skin is transparent. One could prove so by observing the places where it detaches itself thinly against the light, such as the borders of the interdigital space, the outer ear, and the eyelids. And in women, this transparency increases with the degree of delicacy of the skin. So it follows that the coloration of the parts that it covers, like the red bellies of the muscles and the white and pearly aponeuroses, can appear through the skin to some degree in certain places.

The multiplicity of small wrinkles described above gives the skin tone its matte quality. And the pattern of follicles, abundant and widespread, adds a new element to the preceding ones.

These follicles, which cover the entire surface of the body, give it a final luminous envelope, which is shiny under certain conditions because the hairs are often blond and catch the light. They are quite visible on the profile, where they create a sort of aura, but they also exist on other surfaces where they also play a role. Can their direction not contribute to give these surfaces a certain aspect that creates, at least in part, that which one calls the envelope of the form?

B. The Hair

Among the dependents of the skin, I will not speak of the nails, of which even a superficial observation will sufficiently inform the artist. It is not the same for the hair, which, apart from the hair on the cranium and the beard, passes generally unnoticed. However, it should be known that humans, like animals, have the whole surface of the body covered with a true coat of hair. The primary difference in humans is that, apart from certain very limited regions, these hairs do not achieve complete development and remain in the follicular stage. The study of them is no less important, because they exist with equal abundance in men and women. The only parts of the body lacking them are the soles of the feet and the palms of the hands.

The hair arises from the depth of the skin, in the middle of fatty rings in the panniculus adiposus, from a swollen part known as the *bulb* that forms the root of the hair (Figure 27, C). It is housed in a sort of elongated pouch composed of several coverings or membranes whose bottom is occupied by a papilla, from which the elements of the hair are derived. This pouch is the *hair follicle,* which adjoins other organs placed laterally around it. First, one or two small sebaceous glands are placed around the follicle. Their excretory canals open into the top of the same follicle. The product of their secretion is sebum, a fatty material that spreads out on the surface of the skin and lubricates it.

Some smooth muscle fibers[34] form the erectors of the hair. These small muscles originate in the deep layers of the dermis and are shaped like cylindrical or flattened beams. They arrange themselves diagonally, in twos and threes towards the bottom of the follicle to which they are attached, and implant themselves on the follicle a bit below the sebaceous glands. When these beams contract, the follicles are lifted and projected outwards, forming myriad small elevations on the exterior surface of the skin, whose ensemble constitutes the phenomenon known as goose bumps.

When we consider the coat of a horse, one notices that its hair is arranged in variable directions depending on the region, and describes waves that strongly reflect light. In certain places, there are real vortices or centers where the hairs converge, or from which they extend and diverge. In other places they are arranged like large sheets that meet and thus form a projecting line, or to the contrary they diverge, leaving a true part at their point of departure. An analogous arrangement of hair is recognized on the surface of the human body, demonstrated in Figure 27, A.

One sees diverging swirls at the inside corner of the eye, the occiput, the fold of the armpit, the crease of the groin, the inside corner of the buttock, and at the back of the foot and hand. One finds converging swirls under the corner of the jaw, on the olecranon, the navel, and at the root of the genitals.

A long nodal line along each side of the torso joins the swirl of the armpit to that of the groin. Hairs diverge from each side of this line. To the contrary, on the median line of the torso in front, as in back, one sees the hairs converge to form a kind of long tuft.

While most hairs remain in the follicular state, in certain well-defined regions they develop completely to form the hair on the cranium, the eyebrows, the beard, the hair in the armpit and the pubic region. Strictly limited to these regions, hair growth is constant and normal. But in men, it often happens that hair follicles achieve a rather pronounced growth in other places as well. This happens frequently along the whole length of the limbs. In the torso, it is not uncommon to see actual tufts of hair on the middle of the chest, the tops of the shoulders, the sacral region, the region below the navel, and along the median line.

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[34] From a functional point of view, the smooth muscle fibers distinguish themselves from striated muscle in that they do not contract under the influence of will. They only enter into reflex actions. They exist in other parts of the body, in particular the walls of the intestine, where they exclusively create the muscular layer.

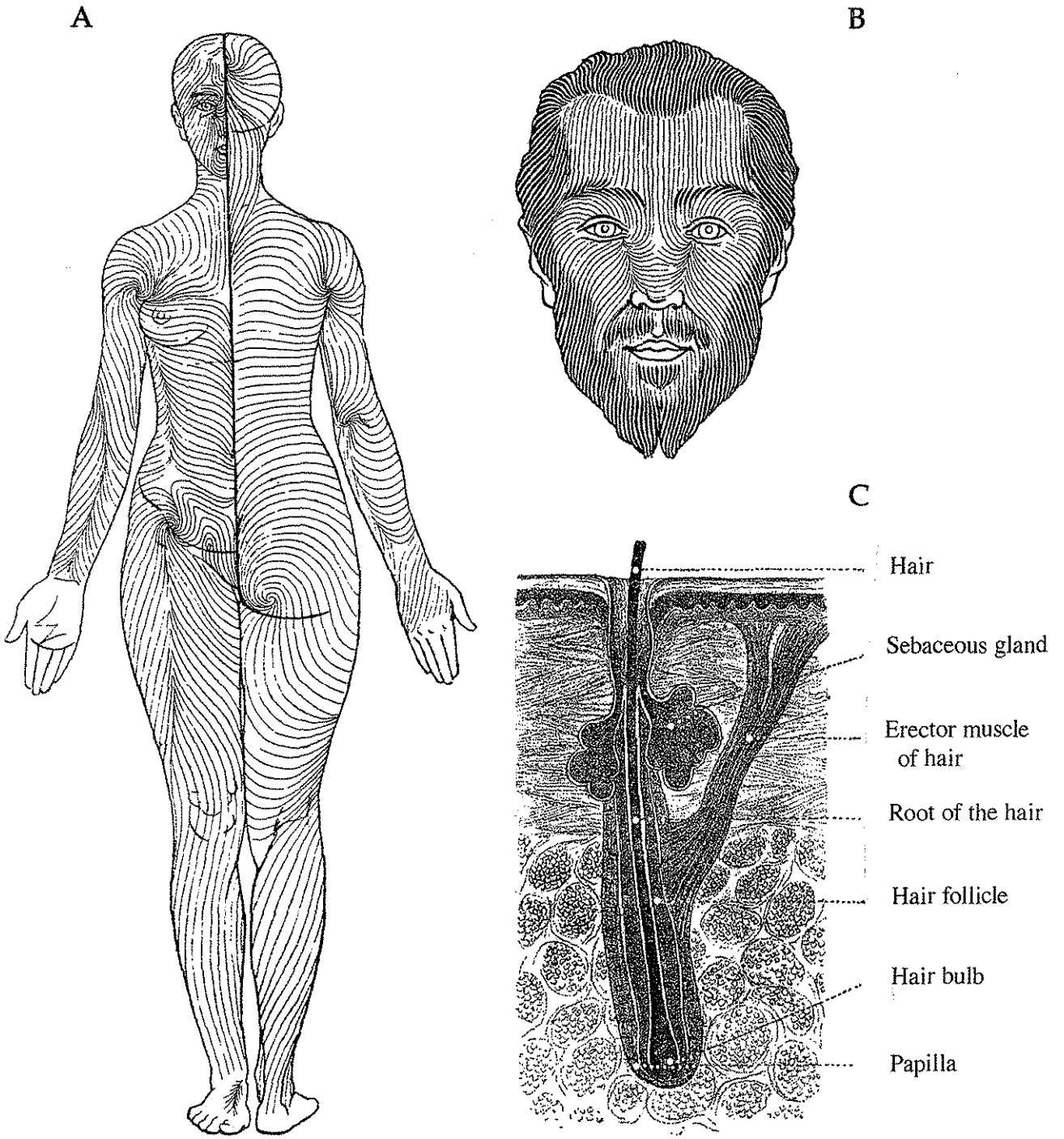

Figure 27: Hair

A. Lines of implantation and direction of the hair on the surface of the body in men, as in women, after Beaunis and Bouchard[37]

B. Lines of implantation of the hair on the head. The follicular hairs are represented by fine lines that become thicker in the places where the hairs come to their complete development to form the eyebrows, the hair, and the beard.

In women, the skin and its dependents present particular characteristics. The skin is notable for its fineness and paleness. If the hair on the cranium is longer and more abundant, all the hairs at the surface of the skin are reduced to the follicular stage. The only exceptions to this are the fold of the armpit, which is occupied by some sparse tufts of hair, and the region of the pubis, which in the arts is customarily represented as hairless. While the presence of hair in this region is constant in women, it should be noted that the area of the hair remains strictly limited, and does not pass the transversal crease that marks the superior border of the pubic region. However, in men, the hair can climb into the hypogastric region and also to the inside parts of the thighs.

Women, by their very constitution, are subject to special biological conditions that we do not need to discuss in detail here. It will suffice for us to note that recent scientific works have shown that the accumulation of fat is one of the necessary consequences of these biological conditions. The lesser quantity of cutaneous pigment and the scarcity and lack of coloration of the body hair could also be related to the same biological conditions. An intimate correlation exists between fat deposits and pigmentation within an individual, and, since the beginning of the last century, a biological law has been stated which says that the proportion of pigment in the epidermis is in inverse proportion to the amount of adipose tissue below it.[35] This law has not been disproved.

The intimate processes of the life of the male tend towards an opposite result. And the morphological consequences of this opposite physiological orientation create two representative types of gender whose extremes are: a very thin yet strongly pigmented male, and a female endowed with specific fat deposits and lighter skin coloration.

Naturally, these extreme types do not represent every individual because some women are rather masculine and some men are rather feminine. The physiques that are predominantly masculine or predominantly feminine are certainly the most frequently encountered in humanity. But at the extremes of sexual differentiation, one can recognize subjects that are very masculine or very feminine, in which we find a greater expression of the pigmentation and adipose characteristics in question.

The evolutionary theories in favor today give us a very distant ancestor who was still close to an animal. The male would have been remarkable for the strength of his muscles, the absence of fat below his skin, the dark coloration of his skin, and the abundance of hair spread over the surface of his body. In this primitive age, the sexes would only have been distinguished by the existence of special organs necessary for reproduction. Without the secondary sexual characteristics, the man and woman would have seemed to resemble two brothers. After a long time, under the action of various causes that are still unclear, a progressive transformation took place that led to the realization of the present human body types. We are endowed with less vigor, a variable quantity of fat, a skin coloration that may be darker or lighter, and on which the hair has largely disappeared, remaining abundant only in certain determined places.

But as a result of biological conditions inherent in their constitution, somatic differentiation has been more considerable in women than in men. The modern man is depigmented, but less so than the woman. He is less hairy than his ancestors, but more so than his companion. And though he may be fatter than his primitive ancestors, he still does not possess the adipose forms which are specific to the feminine sex.

This theory, which gives a similar origin to the morphology of men and women, has led to the realization of two extremely differentiated types. We have the male with brown skin and a hairy chest, intense skin pigmentation,

[35] This law applies to an individual; whether that person has dark or light skin, the skin will generally be lighter in tone where fat is more abundant, and darker where it is less so.

and projecting muscles under a thin panniculus adiposus. In contrast, we have the female with transparent reddish skin, long hair and sparse body hair, and specific, highly developed fat deposits.[36]

[36] This interesting question has been very well treated by Dr. P. Clergeau in his work: *Différenciations adipeuses et pigmentaires du type féminine au point de vue de la physiologie, de l'art et de l'anthropologie*, from which I have borrowed the principal details above.

IV. EXTERIOR FORMS OF THE REGIONS OF THE BODY

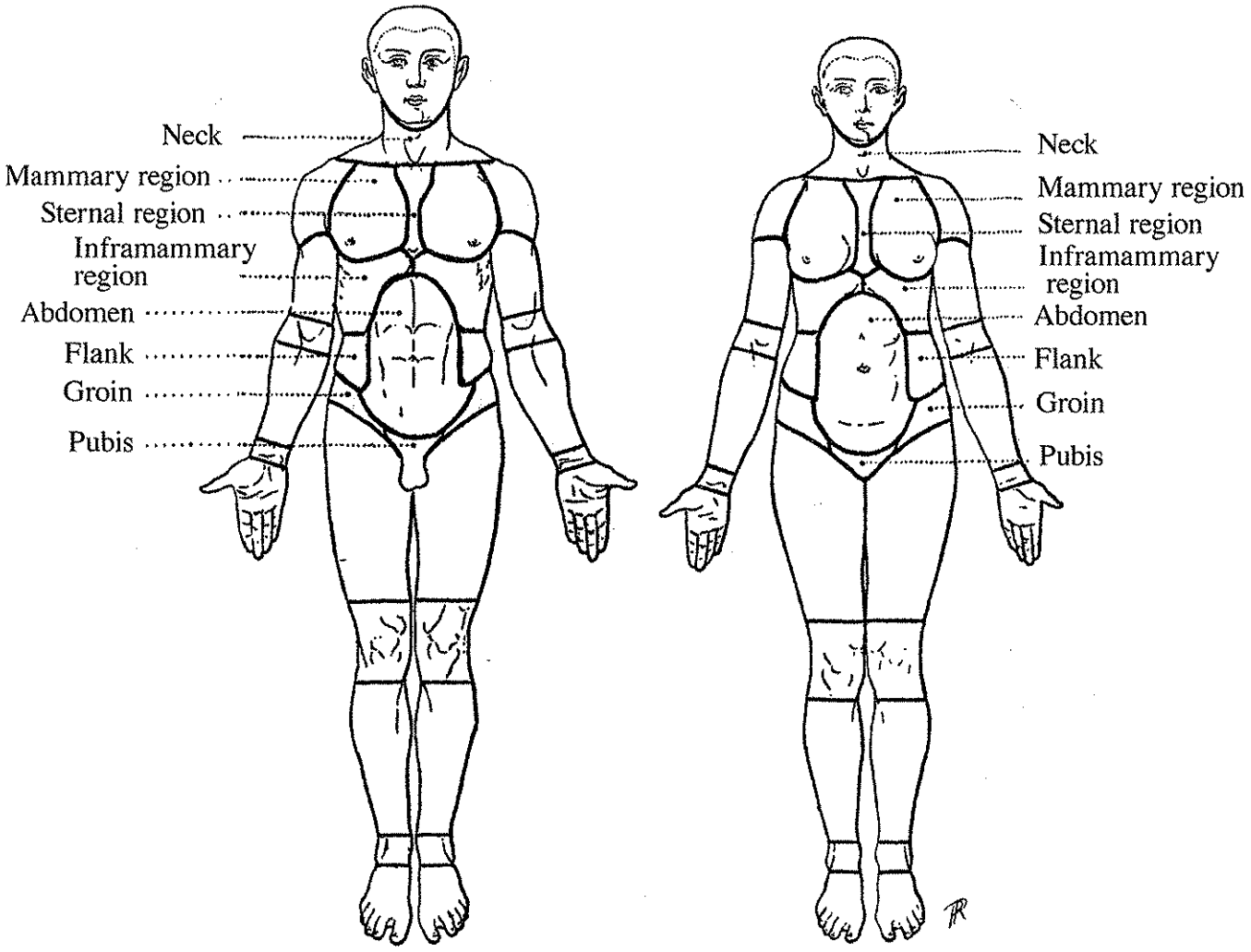

Figure 28: Morphological topography comparing a man and a woman; front view

In the descriptions of the female nude, we will loosely follow the divisions of the surface of the body into several regions to facilitate the study of its morphology, as was done in detail for the male nude in my previous work.[37]

I think it is helpful to reproduce these diagrams (Figures 28 and 29), which were presented in my first work, primarily because they demonstrate the fundamental morphological analogies between men and women. To some extent, these illustrations also make up for the absence of a detailed description of the points of demarcation of the regions of the body in the following text.

The result, in this publication, is a simplification that is only possible today because of my previous study. It is important always to keep in mind the spirit of that work: its precision, and degree of detail. I therefore invite the reader to refer to it, if necessary, for the clarity of that which will follow.

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[37] P. Richer, *Anatomie Artistique*, 1890. Paris: Plon, Nourrit, 1890.

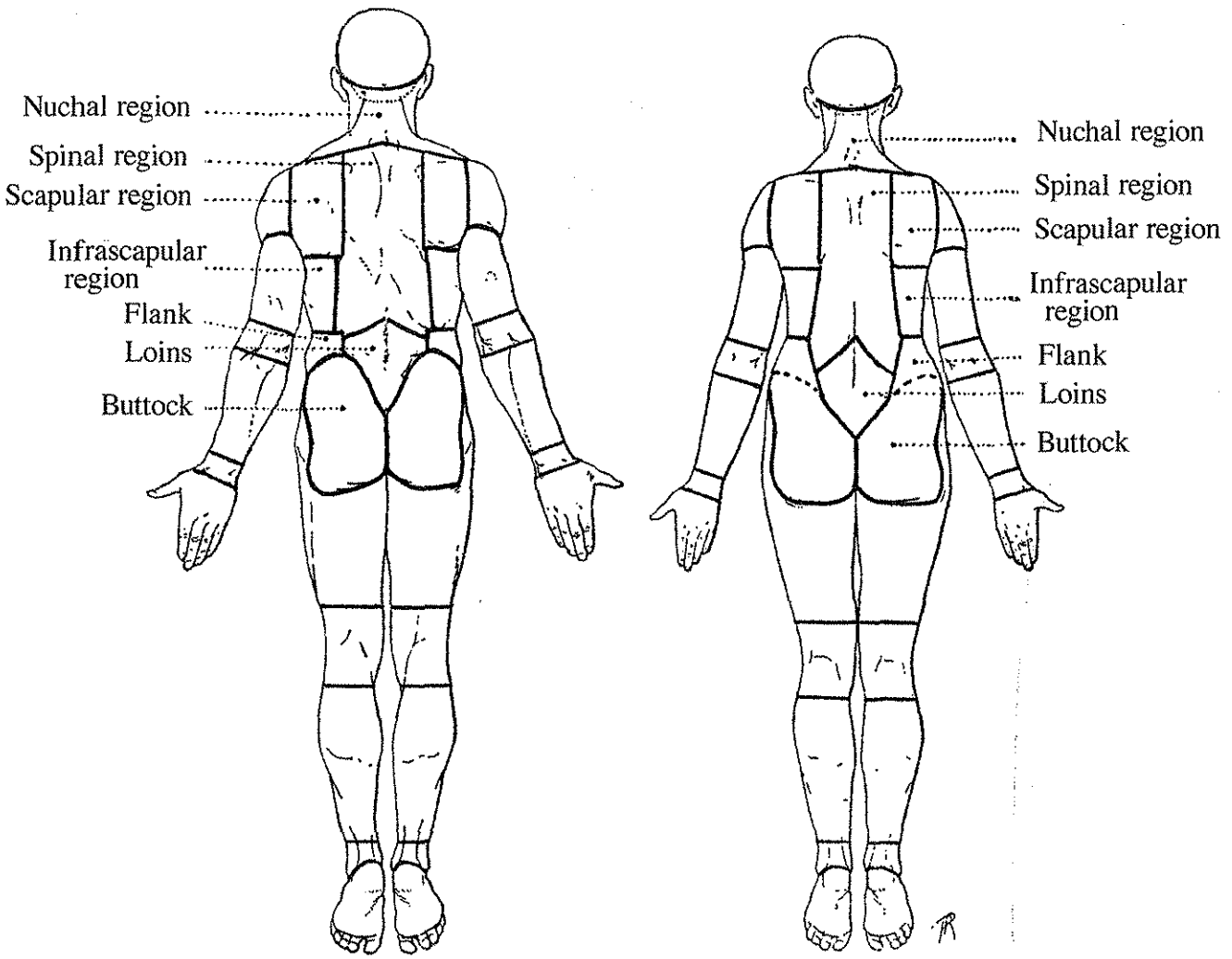


Figure 29: Morphological topography comparing a man and a woman; back view

Because men and women are derived from the same type, deepening the knowledge of one will facilitate and clarify the study of the other. When I present the female morphology, I assume the reader has knowledge of male morphology and will not give it less attention. By a natural action and reaction, a complementary pair provides very useful clarification, especially from the point of view of their overall shapes and generalizations. In this text I will most often start from the masculine form, which should be well known to the reader, and show how by simplifications or slight alterations, we discover the constitution of the feminine form. At other times we will follow the opposite route. It should be well understood that I have in mind the most pronounced and exemplary types that, as I have already shown, occupy the opposite extremes of a series composed in nature of a quantity of intermediate forms that partake of both qualities to a greater or lesser extent. Certainly, many men have some feminine qualities and likewise, many women present varying degrees of masculine characteristics.

A. The Head

In the form of the head, the skeleton holds the primary place. At its summit, the cranial box draws its oval shape underneath the hair, which only veils its details, while the frontal bone produces the shape of the whole upper part of the face at the forehead. We will also see the dominant part that the nasal bones, the zygomatic bones, and the two jawbones play in the conformation of the rest of the face.

The differences that exist between men and women in the bony framework of the head generally create the traits that are most characteristic.

1. Forehead

The forehead is divided into two planes that join, at a more or less obtuse angle, at the level of the frontal eminences. For women, this is closer to a right angle, while for men it is greater. Thus, in women, the inferior plane of the frontal bone is almost vertical and the frontal eminences project more, while in men, the forehead is inclined backwards and the frontal eminences are generally less pronounced.

The forehead nearly replicates the shape of the bone below, though not always completely. While the frontal eminences of the skull are perfectly seen beneath the skin, the nasal eminence, in certain subjects, occupies the bottom of a depression created by the lateral projection of the masses of the eyebrows. A crucial difference exists between men and women on this point. In men, the nasal eminence is always well accentuated and accompanied by a thick eyebrow region on either side. It creates a strong diagonal projection that terminates the forehead from below and sits on top of a notch which may be rather deep, the *glabella*, that leads to the root of the nose. In women, to the contrary, the nearly vertical plane of the forehead descends without stopping until the level of the orbits and continues without interruption into the bones of the nose. The glabella and the bony brow ridges are very subtle forms in women (Figure 30, A).

However, the arch of the eyebrow should not be confused with the superior orbital ridge, which terminates the frontal bone from below. Superimposed on their medial part, these two arches almost always separate themselves as a consequence of the different directions they follow as they move laterally; the eyebrow directs itself a bit upwards, while the orbital ridge descends. Thus, the eyebrow rests entirely on the frontal bone and the external orbital ridge is situated a bit below the tail of the eyebrow, making its relief under the skin of the upper eyelid and to the outside of the eye socket (Figure 39: B, C).

Figure 30: (right) Normal forehead and eye

A. Feminine forehead with a sketch transforming it into a masculine forehead by the backwards inclination of its entire upper part, and the projection of the brow ridge and nasal eminence, giving rise to the indented shape of the root of the nose.

B. Eye of the same subject seen from the front

C, D, E. Other eyes belonging to another subject. They are seen in three views: in profile, three-quarter, and frontal view, and are represented open (C), half-closed (D), and completely closed (E).

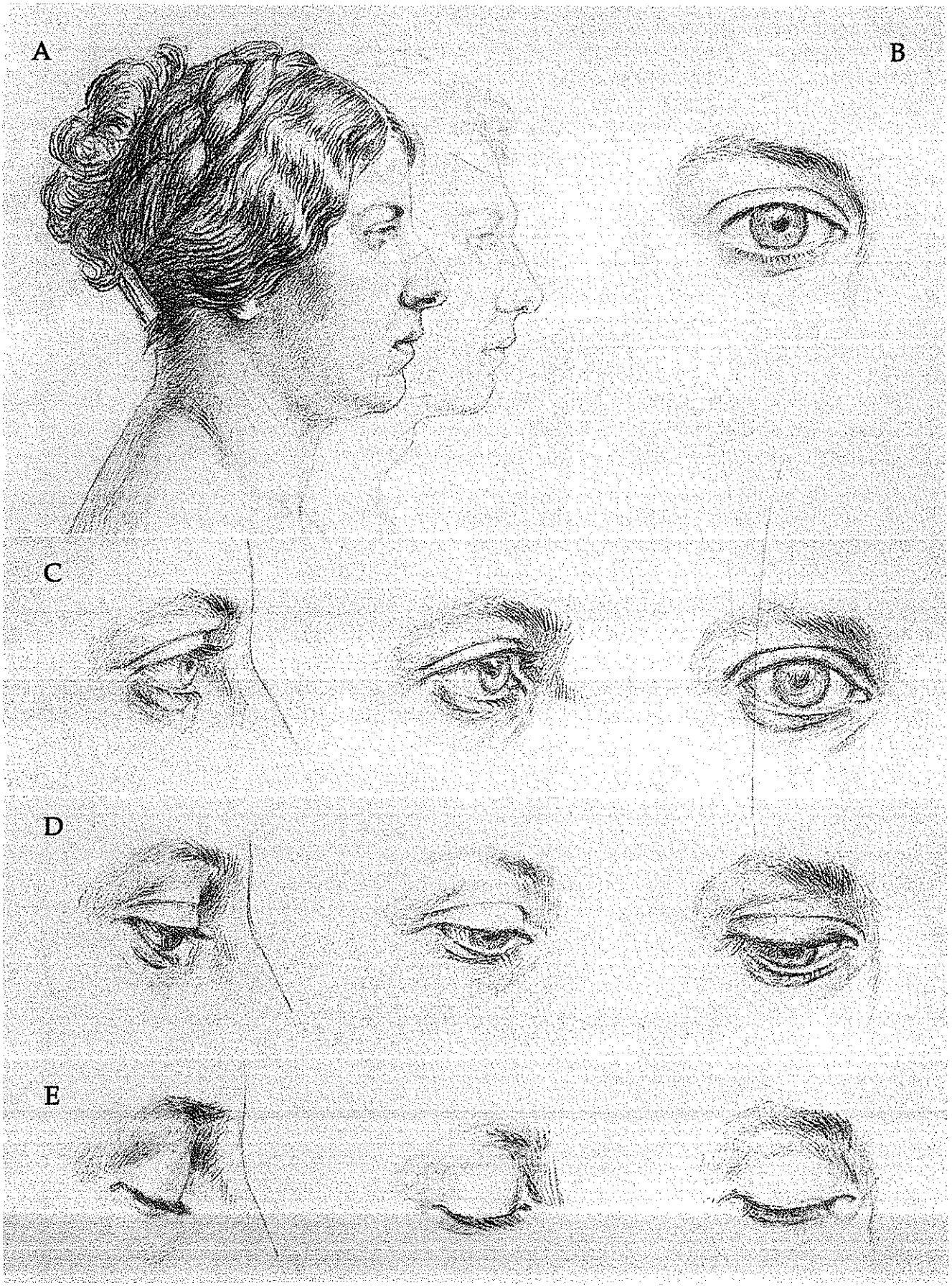


Figure 30: Normal forehead and eye

2. Eyebrow

The eyebrow is a raised transversal region of the skin that is covered with hair and separates the forehead from the upper eyelid. The skin is thick and very mobile. It is lined with fat, and at its deep surface, the eyebrow is attached to several muscles of expression that serve to move it.

In repose, the eyebrow describes the arc of a slightly angular circle along its inside half. It is sometimes straight, but always clearly defined. The hair that composes it is of the same color as the hair on the cranium. The direction of the hair of the eyebrows is not the same in all regions. At the inside, the hairs are always directed upwards and lie on top of one another. They form the thickest part of the eyebrow, called the *head of the eyebrow*. They then incline themselves together towards the outside and take a horizontal direction, becoming longer and sometimes bristled. Then, advancing to meet the hairs coming from the forehead, they come together like a sword, thinner and narrower; this is called the *tail of the eyebrow*.

The space between the eyebrows is usually completely bare, though sometimes it contains hairs that make the two eyebrows join together on the median line. Great variations exist as to the quantity and length of the hairs that adorn the eyebrow. In women, the arc of the well-drawn eyebrow is thinner and more accentuated; the hairs are strictly limited to a narrow region.

The placement of the eyebrow in relation to the eyeball is variable. The eyebrow may be near or far from the eye, thereby diminishing or augmenting the height of the upper eyelid. It may be placed high, on the same plane as the frontal bone, or it may descend to the upper limit of the eye socket. The higher it is, the more its curvature increases. The lower it is, the more it becomes horizontal (Figure 31: C, H, J).

Under the influence of emotions, the eyebrow raises or lowers itself, exaggerating its curvature or becoming straight, horizontal, or oblique in one direction or another. In older people, the eyebrow keeps one of the transitory forms of the emotions even in a resting position, imprinting a permanent expression on their physiognomy.

Figure 31: (right) High and low eyebrows

A,B,C,D. Example of an eyebrow placed very low, with less height of the upper eyelid in a young model seen in profile (A), lost profile (B), in 3/4 view with open eyes (C), and 3/4 view with eyes half closed (D).
E,F,G. The eyes of the same model in frontal and profile views: wide open (E), half-closed (F), and closed (G).
H. A different model showing an eyebrow placed high, seen in profile.
I,J,K,L. On the same model, the open eye is seen from the front (I), closed (J), half-closed from the front (K), and half-closed in profile (L).

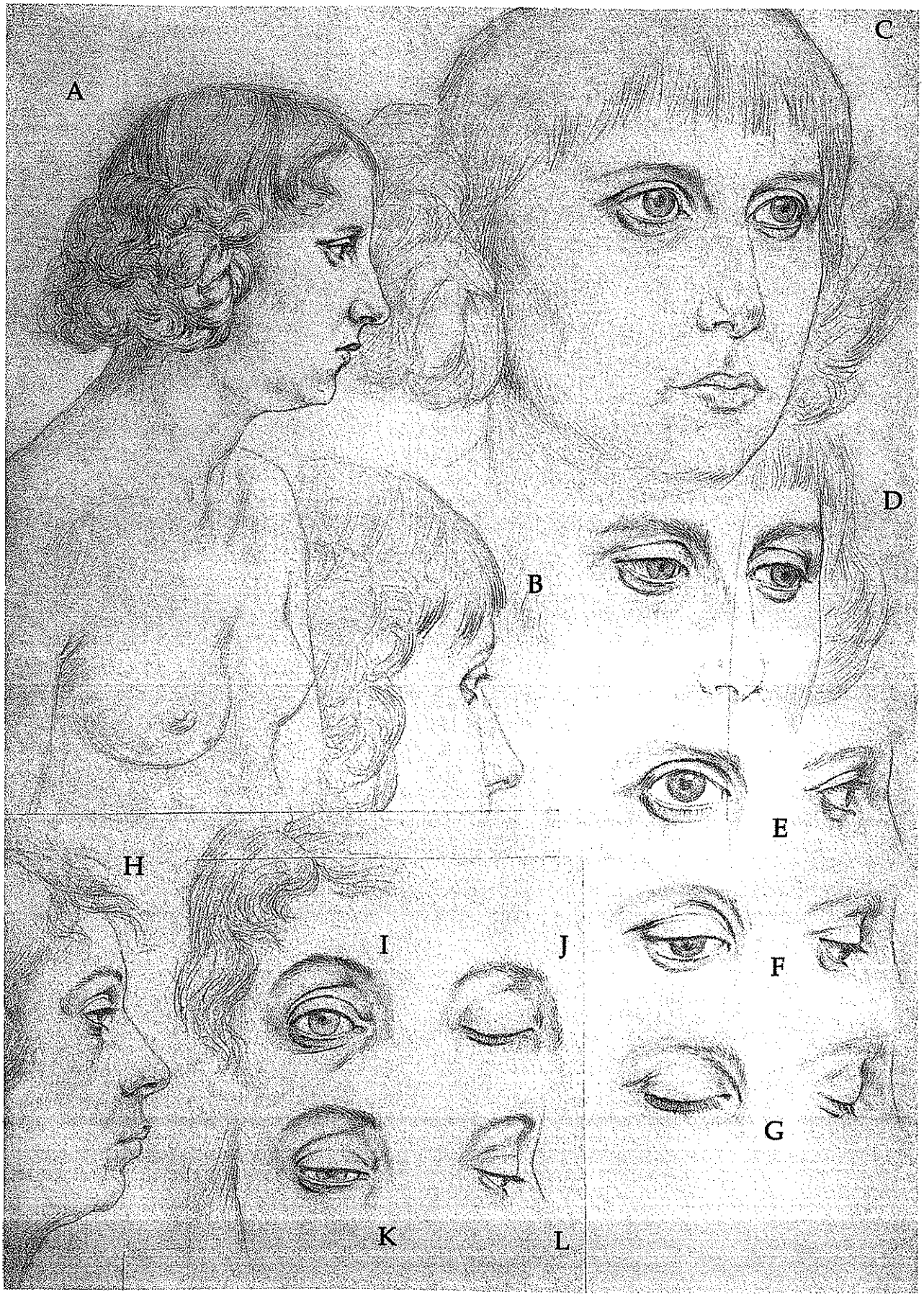
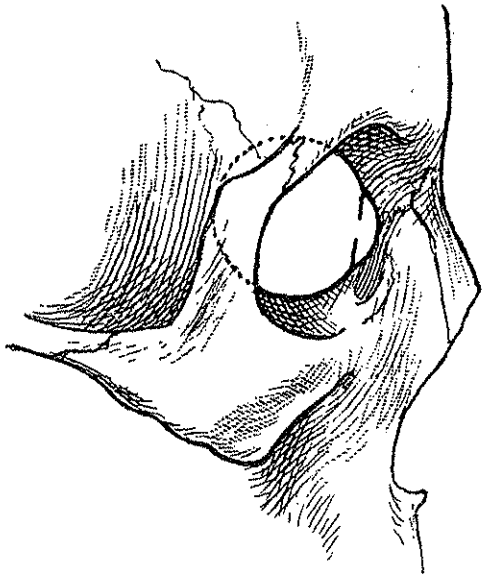


Figure 31: High and low eyebrows

3. Eye

a. Orbital cavity

Lodged in the interior of the socket, along with the muscular apparatus designed to move it, the eyeball reveals only a portion of its anterior surface through the opening of the eyelids. It is embedded in the bony quadrilateral that forms the periphery of the orbital cavity. This portion of the skeleton can be felt all around the eye and plays a crucial role in the forms of the region. Dalou said that it is not difficult to model an eye, but that the difficulty is to embed it well within the skeleton. Therefore, it is important to clarify the relationships between the eyeball and the edges of the bony cavity that shelters it (Figures 32- 34).



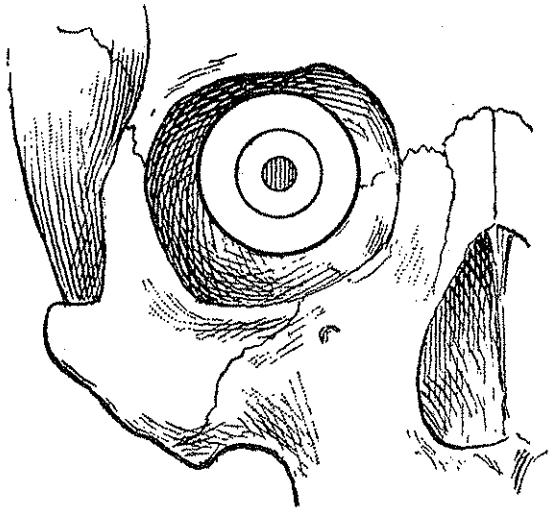


Figure 32 (above, left): *Showing the eyeball revealed on the lateral side by the external orbital ridge, placed further back than the other edges of the orbital cavity.*

Figure 33 (above, right): *Eyeball embedded in the orbital cavity*

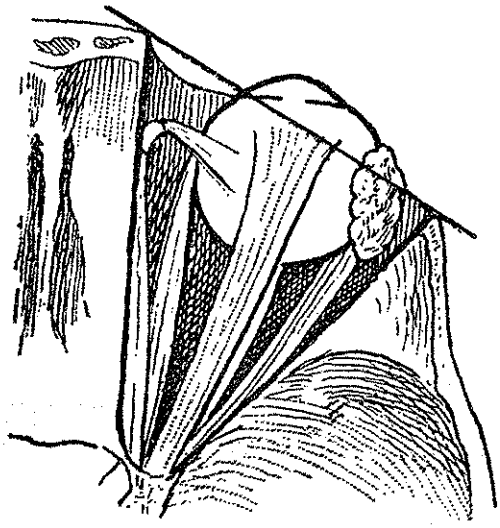


Figure 34 (left): *The eyeball surrounded by some of the muscles that serve to move it, with the lacrimal gland placed above and to the outside (superior view). The upper wall of the socket has been sectioned. A tangent line between the inner and outer edges of the orbit shows how the eyeball, protected from all around, finds itself revealed on the outside.*

The upper edge of the orbit projects most; in women it is like a fine, light stroke. It is part of the frontal bone and supports the eyebrow. The lower edge, formed by the corresponding edges of the zygomatic bone and the superior maxilla, is only slightly visible, if at all. The orbit descends towards its outside edge. The internal side blends with the lateral planes of the nose, while the external side is concave and set further back. Because the eye is less sheltered on the outside, it appears in its entirety on a head seen in profile (Figure 32). Looking at the skeleton, it is clear that the orbit does not face directly towards the front. It is contained in a vertical plane that is inclined slightly downwards, and at the same time strongly turned outwards. The eyeball is placed in the middle of the orbit, though closer to the upper edge than the lower, and directed straight ahead. As a result, it is protected from the inside by the root of the nose and from above and below by the edges of the superior and inferior orbital ridges. However, the eyeball is almost completely exposed on the outside because the lateral side of the orbital cavity is situated further back and is concave in shape.

In addition, the eyes may be more or less sunken into the orbital cavity depending on the individual. Projecting eyes that protrude from the head are opposed to those that are deeply set. In the first case, the palpebral fissure is pushed forward more and opens itself wider, so the eye appears round. In the second case, to the contrary, the palpebral opening is smaller and more almond-shaped, so the eye appears smaller (Figure 42: A, B, C).

The apparent size of the eye therefore depends on two factors: its degree of projection, and the opening of the palpebral fissure. The eyeball itself only presents minor variations from one individual to another, with no correlation between the variety of its outward shape and the range of its apparent size.

b. Eyelids

A fibrous partition extends itself in front of the eyeball and attaches to the rim of the orbit. It essentially forms the skeleton of the eyelids, which are applied directly onto it. This partition is divided into two parts by its appearance and texture: the central, and the peripheral parts. The central part circumscribes the opening of the eyelids and is formed by two pieces of a cartilaginous appearance; durable, supple, and flexible: these are the *tarsal plates* (Figure 35). They differ in shape and size between the upper and lower eyelids. The upper tarsus resembles a crescent with the convexity directed upwards. It measures one centimeter in height at its center. The lower tarsus takes the shape of a long rectangle arranged transversely, and is one-half centimeter in height.

The two tarsi are applied and molded, so to speak, on the eyeball. Their internal and external ends are joined together by a ligament that is solidly attached to the corresponding side of the orbit.

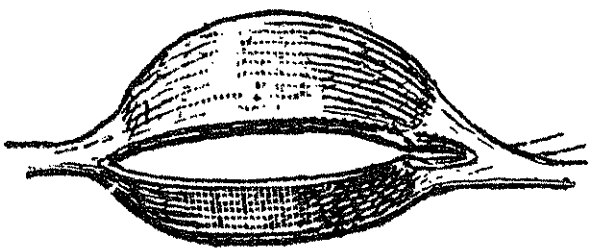


Figure 35: Tarsal plates

The peripheral part of the partition extends itself all around the tarsi and their ligaments to the edges of the orbit. It is formed by the *suspensory ligaments* of the eyelids. These have a much weaker and more uneven fibrous structure, and serve to close the front of the orbital cavity (Figure 36).

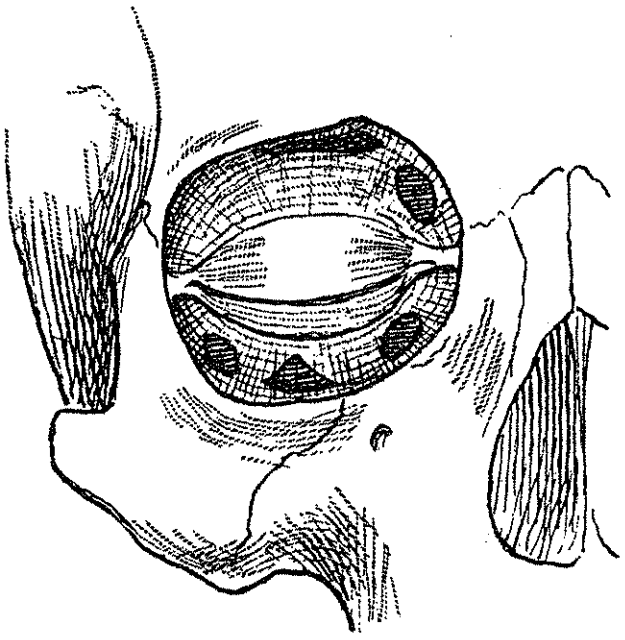


Figure 36 (left): Wall completely sealing the base of the orbit. *This wall is formed by the tarsal plates in the center and by the suspensory ligaments on the edges. On its surface are weak areas, indicated here with grey shapes, where the fat may herniate through.*

It should be added that this cavity is filled to its limits with a fatty tissue in which the optic nerve, the eyeball, the muscles, and all the other organs, vessels, and nerves that make up the apparatus of vision, are embedded. The purpose of this fat is to maintain the delicacy of the area during the movements of the eyeball. But, by its abundance or its absence, this fat can herniate across the weak parts of the suspensory ligaments, making it an important morphological element of the region.

The fibrous partition I have described closes the front of the orbital cavity and constitutes the deep layer of the eyelids, of which it makes an integral part. There is a middle layer applied on top of the fibrous partition consisting of the orbicularis oculi muscle, as well as a superficial layer formed by the skin, which is particularly fine and delicate here. These three layers are closely bound together (Figures 37 and 38).

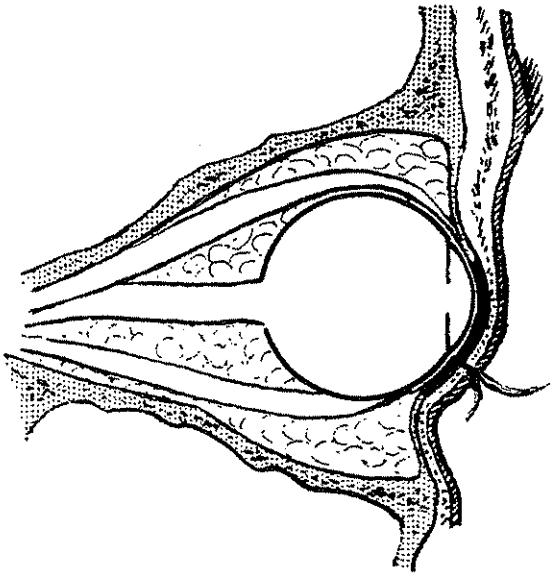
The upper eyelid begins immediately below the eyebrow, while the lower eyelid continues down into the skin of the cheek. Without speaking of the palpebral fissure, the separation of the two eyelids is marked on the inside by a small transversal relief that is created by the internal tarsal ligament and strongly reflects light. In contrast, there is a depression at the corresponding point on the outside, which separates the eyelids and rests on the external tarsal ligament. The upper eyelid is much longer than the lower.

The eyelids are membranous sails that extend from the edges of the orbit to the front of the eye. They are each composed of two parts: a *central part* at the tarsus (tarsal portion), in contact with the eyeball itself, and a *peripheral part* beyond the first, resting on the soft parts that separate the eyeball from the bone of the orbital cavity (orbital portion). First, I will describe the tarsal portion of the two eyelids, and then the orbital portion.

c. Tarsal, or central portion of the eyelids

This part of the eyelid rests directly on the eyeball and reproduces its round and prominent shape; it circumscribes the palpebral fissure, and by its movements, permits the opening and closing of the eye. The greater part of this movement occurs in the upper eyelid, which rises or descends in front of the eyeball, molding itself over it, while the lower eyelid only undergoes rather restricted movements.

The borders of the palpebral fissure are created by the free edges of the eyelids, which rejoin each other inside and outside forming two corners: the inside, or large corner, and the outside, or small corner (Figure 40).



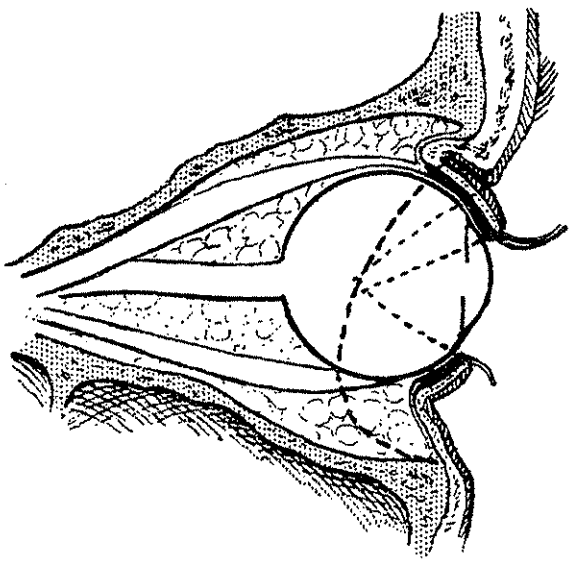


Figure 37 (above, left): Closed eye

Figure 38 (above, right): Open eye

The dashed line indicates the lateral edge of the orbit and the dotted lines show the edges of the eyelids. Structure of the eyelids, composed of three layers: a deep layer (in black) formed by the suspensory ligaments attached to the edges of the orbit and the tarsal cartilage; an intermediate layer (in white), and a superficial layer, the skin (in grey).

The free edges of the eyelids have a certain thickness; typically one or two millimeters. They are closely applied against the eyeball and are slightly rounded off. They carry the eyelashes, distributed in irregular lines, along their whole thickness, so it follows that the row of lashes is not a perfectly thin line, but somewhat thick.

The eyelashes are longer for women than for men. Lashes from the upper eyelid are longer and curve upwards. At the lower eyelid they are shorter and curve downwards, so that in closing the eyelids, the eyelashes lean against each other by their convexity, and it happens that those of the lower eyelid disappear completely under the shelter of those above.

When the eye is open, the free edge of the upper eyelid is shielded by the shadow of the eyelashes, while that of the lower lid, presenting itself uncovered, strongly reflects the light. Finally, the edge of the upper eyelid describes an arc that is much more pronounced than that of the lower eyelid.

The inside corner of the eye has the shape of a rounded notch, filled with a small pink elevation formed by a mass of sebaceous glands called the *lacrimal caruncle.* One should not confuse it with a gland of the same name, the *lacrimal gland*, which is not visible, buried under the superior lateral corner of the orbit (Figure 34). The part of the free edge of the eyelids that surrounds the lacrimal caruncle does not have eyelashes. It rejoins the lashed part with two small projections, one above, the other below, which are pierced at the top by a small opening that leads the tears destined to lubricate the eye from the tear ducts, which originate within the nasal passages.

The external corner is rather acute and marked by a superficial groove that extends the line of the free edge of the upper eyelid.

Because of the tilt of the orbital cavity, opening downward and outward as I have already noted, the inside corner of the eye is situated on an anterior plane to that of the outside corner. In addition, the line that passes through the two corners of the eye and constitutes its axis is not perfectly horizontal. It runs a bit higher on the outside; an accentuation of this shape is one of the characteristics of the Asian eye. When the eye is closed, the upper eyelid covers the outer corner, which seems to descend.

d. Creases of the eyelids

The central and clearly spherical part of the eyelids is separated from the peripheral part by a circular crease, which is interrupted at the corners of the eye and thus divided in two: above, the crease of the upper eyelid and below, the crease of the lower eyelid.

When the eyes are closed, the crease of the upper eyelid, wide and shallow, outlines the veiled globe of the eyeball. It therefore follows a curved path of downward concavity, beginning from the inside above the lacrimal caruncle and ending in the depression situated near the outside corner of the eye.

When the eyes open (Figure 38), the tarsal portion of the eyelid is pulled upwards, along with the tarsus itself, at whose upper edge the levator muscle of the upper eyelid is attached. The tarsal portion folds itself beneath the orbital portion, which covers it, though not always completely. Indeed, along its free edge, a few millimeters of the upper eyelid still remain visible. This area appears as a wider or smaller rim according to the individual; it is slightly puffy in children and some women, and always wider in the center above the pupil than it is near the corners of the eye.

The crease of the upper eyelid is a kind of shallow valley when the eye is closed, or a pronounced fold when the eye is open. It corresponds to the crease of the lower eyelid, which is less curved, less deep, and located closer to the palpebral opening. The crease of the lower eyelid arises below the lacrimal caruncle and takes the shape of a curvilinear depression, ending at the outside corner of the eye.

This tarsal portion of the lower eyelid is usually slightly plump, and much less tall than the corresponding region of the upper eyelid. It does not exactly reproduce the shape of the tarsus on which it rests. The lower eyelid rises up slightly when the eye closes, reaching out towards the upper eyelid. This action extends its path and makes the crease that delineates it from below even more shallow. When the eye is wide open, it descends further, turning its free edge against the light and curving the rim of the eyelid even more. This diminishes a bit of its height, but the crease of the lower eyelid never folds very deeply.

Figure 39 (right): Eyelids

A. Orbital portion of the upper eyelid is horizontal

B, C. Orbital portion of the upper eyelid is divided in its height by a crease that emphasizes the external orbital ridge.

D. Orbital portion of the upper eyelid is vertical.

E,F,G. Plump eyes seen from profile and the front: open (E), half-closed (F), closed (G).

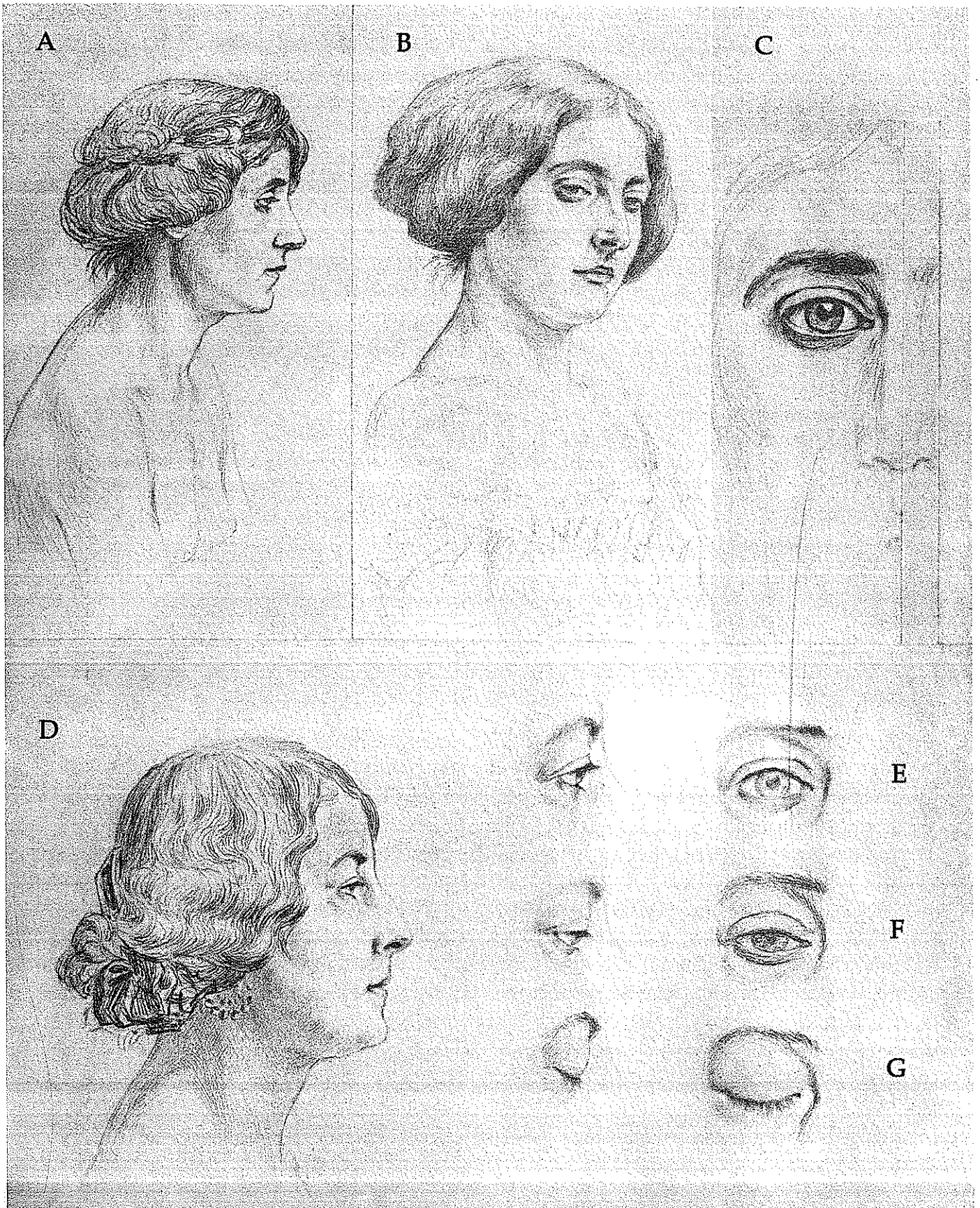


Figure 39: Eyelids

This crease presents many variations. In some people it approaches the free edge of the eyelid, while in others, it may be up to a centimeter away from it. Very often it is quite diagonal, instead of following a horizontal direction, and only exists near the inside corner. It starts from the inside corner, then moves downward and outward, thus giving this part of the eyelid a triangular aspect. The outside part lacks the fold, or only possesses a very slight crease along the tarsus.

The diagonal crease is almost always accompanied by one or two neighboring creases situated below, or more rarely, above it.

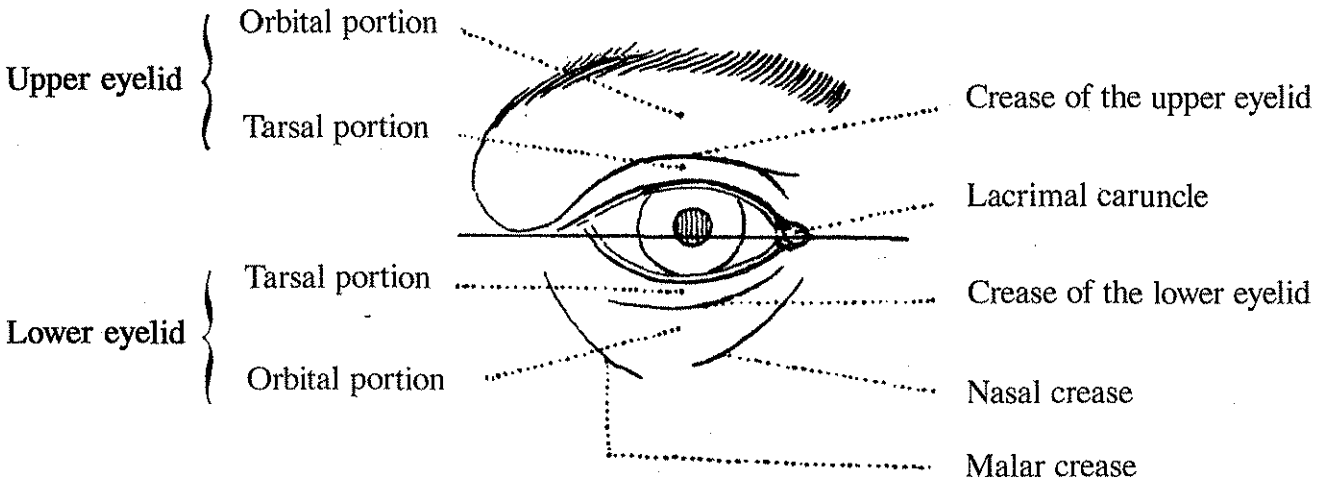


Figure 40: Creases of the eyelids

e. **Orbital, or peripheral portion of the eyelids**

This part of the upper eyelid begins along the lower edge of the eyebrow and finishes at the crease of the upper eyelid in the center, and at the tarsal ligaments on the sides.

The boundary of the orbital part of the lower eyelid is similar; it extends from the crease of the lower eyelid to the edge of the lower border of the orbital cavity, which it usually exceeds a bit to join with the skin of the cheek. Its lower limit is formed by two independent oblique creases, which are quite variably shaped. The inside crease is more consistent and pronounced. It begins below the medial palpebral ligament, descends obliquely at an angle of 45,° and ends rather abruptly, sometimes with a small dimple, at the level of a vertical line passed through the center of the eyelid. It separates the eyelid from the lateral plane of the nose, and is known as the *nasal crease*. Simply a rounded groove in the young and in women, it is accentuated by the play of the muscles. Often it has a distinctive coloration; in blondes, its transparency allows the bluish tint of a vein situated here to show through, while in brunettes, it is sometimes the site of a dark streak that can be up to the hue of soot.

The oblique external furrow, known as the *malar furrow*, is absent in children and young people. It often does not appear until the end of middle age, and can be absent even in the elderly. It is located a bit below the edge of the malar, or zygomatic bone, whose direction it follows. It begins in the fold of the outside corner of the eye and finishes on the inside at the oblique nasal crease described above. Sometimes the two paths come together to form a regular semicircle, giving an oval shape to the eyelid. Most often the two folds do not join; the internal fold descends lower

and there remains a small space between the two that is crossed with irregular wrinkles. Thus, the eyelid appears triangular with one point descending onto the cheek. The accentuation of these shapes only appears in the progress of age.

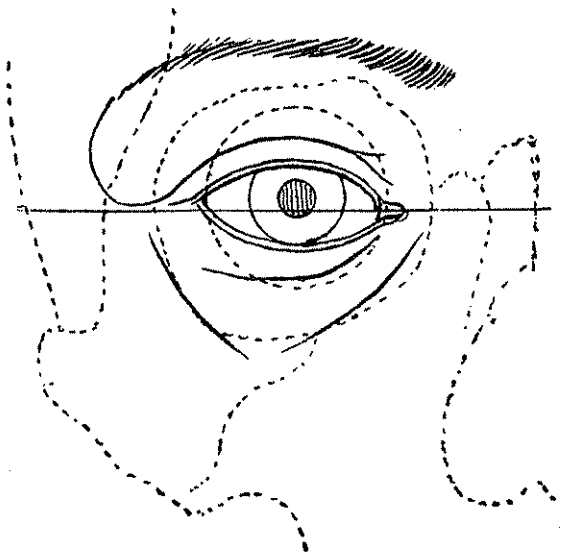


Figure 41: Relationship of the eyeball to the base of the orbital cavity and other features of the skull, indicated in dotted lines.

The peripheral halves of the eyelids offer details of the highest interest for morphological study.

In the upper eyelid, the orbital portion can appear in two different ways. Most often, it forms a true fold that may be thick or thin. The orbital portion descends on the tarsal portion, but always leaves the part of the tarsus nearest to the palpebral opening exposed, as I said earlier. In its upper part, it depresses itself slightly before rejoining the eyebrow. Its lower edge, which borders the palpebral opening, is not always uniformly curved. It sometimes stands up in the middle. This fold ends, from the inside, at the level of a deep depression that marks the inner corner of the eye. From the outside, it surpasses the external corner, extending towards the temple by following either a rectilinear or curved trajectory, and ascending to join with the projection of the tail of the eyebrow.

There is sometimes a second very thin fold that is like a duplication of the first and sits exactly on the tarsal portion (Figure 31: I, K). A similar form occurs when the eye is half-closed, at the moment when the eyelid, rolling itself downward under the influence of a lowering action, sees its orbital portion divided in two parts by a crease that is especially distinct on the outer side: the lower part rests on the tarsus and the upper part rises over the external orbital ridge. These transitory shapes disappear with the complete closure of the eye (Figure 30, D, and Figure 31, F).

In a second more rare aspect, the orbital part of the upper eyelid does not make a projection. It is extended more or less obliquely, like a roof, starting from the eyebrow and going behind the tarsal portion, which therefore appears to a much greater extent. This disposition often accompanies a high placement of the eyebrow (Figure 39, A).

At the lower eyelid, the orbital portion sits under the tarsal portion and is bordered by two oblique grooves at its lower edge, described above. Through its entire inner half, it is depressed above the nasal crease. It rises towards the outside to make a variable projection.

These peripheral portions of the eyelids are frequently the sites of deformations that alter the appearance of the eyes. This may result from a general or a partial swelling, with or without extension of the skin, or by the fat from the orbit coming out to herniate through the suspensory ligaments.

When the eyelids are plump, as they often are in young children, the upper orbital portion descends like a vertical wall on the tarsal part, which it covers almost completely (Figure 39: D, E). This plumpness is sometimes located on the inside part, completely covering the caruncle. While this disposition is almost the rule in young children, it is not rare to see it persist to a certain degree in adolescence (Figure 42: D, D', D"). Its constancy, its persistence at all ages, and its exaggeration, which makes a sort of crescent band that hides the entire inner corner of the eye, is one of the characteristics of the Asian races (Figure 42, F).

Sometimes, the orbital portion of the lower eyelid is also slightly swollen. In this case, its maximum projection is towards the outside and we see an accentuation of the creases that separate it from the nose and the cheek below.

The simple relaxation of tissues has the effect of extending the skin of the eyelids, which is reflected in the following forms:

At the upper eyelid, the orbital portion falls and descends in front of the tarsal portion until its free edge, which it can even hide completely. Sometimes, this falling eyelid only occurs at the outer part, and the opening of the eye takes on a triangular aspect (Figure 42, E). When this ptosis is general and very pronounced, the eyelid does not open completely and the eyes remain veiled.

The relaxation of the skin at the lower eyelid, a necessary accompaniment of age, results in a wrinkling in all directions, though it is most marked in the transversal direction. By the accentuation of folds that border it from below and in front, the lower eyelid often descends unevenly. This wrinkling of the skin is also observed along the whole length of the upper eyelid until the tarsal portion, which is usually quite unified.

The fibrous partition that closes the front of the orbit weakens with age, and fat, which the partition is meant to contain, may herniate across its weakest parts. This always occurs in the same places, and gives rise to certain forms that occupy fixed positions (Figure 36).

At the upper eyelid, fat is only deposited above the inner corner of the eye. Here, it may fill a depression that usually is constant, which produces a fatty projection in this place only (Figure 42, H).

While the fat tissue in question accumulates along the entire length of the lower eyelid, it does so predominantly at the sides. Thus, it may form an actual pouch, which is often observed and accentuated below by two very pronounced lateral grooves that come together (Figure 42: G, H, I, J). The wrinkling of the skin caused by its loss of elasticity in the second half of mature age, and in old age, tends to add and superimpose further deformations upon the fatty tissue.

Figure 42 (right): Morphology of the eye

A, B. Two examples of a deep-set eye, which is thus rather far from the root of the nose in profile
C. Projecting eye
D, D'. Bridled eye, seen in profile and 3/4 view
E. Triangular eye
F. Eye of a Japanese person
G. Fatty bag at the lower eyelid
H. Fatty bags at both eyelids, seen from the front and profile
I. Fatty bags at the lower eyelid, seen from the front and profile
J. Fatty bags at both eyelids, seen from the front and profile

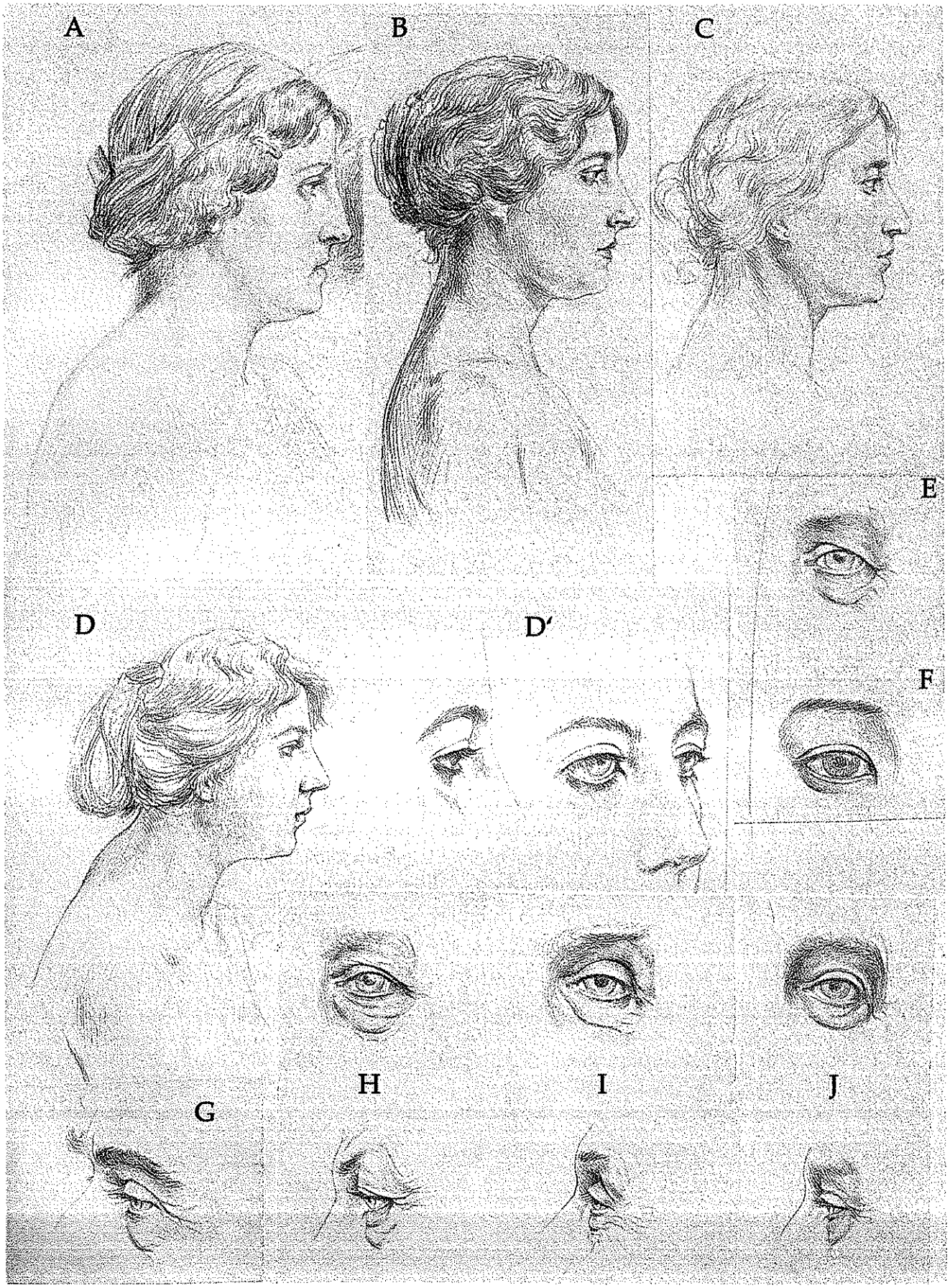


Figure 42: Morphology of the eye

f. Eyeball

Without entering into the details of the constitution of the optical apparatus that is the organ of vision, a veritable black chamber, we must now say a few words on the portion of the eyeball that is visible through the palpebral opening.

At the center, a segment of the sphere appears, transparent like crystal and of a convexity like that of a watch glass. It is the *cornea*, set as it is in the white membrane called the *sclera*, which is very solid and durable and forms all the rest of the eyeball. The relief of the cornea on the sclera is such that it is perfectly visible through the closed eyelid. Only a small portion of the sclera is visible when the eye is open. It is covered by a very fine yellowish-white membrane, the *conjunctiva*, which faces the inside of the eyelids and ends at the border of the cornea. The white of the eye is more or less pure according to the conjunctiva, which is always dotted with small vessels and can be more or less bloodshot, or infiltrated with fat. It is bluish white in children, when the sclera is thin and the conjunctiva little permeated with blood vessels. This allows the black tint of the membrane that lines the interior of the eyeball, as in all optical devices, to be visible through the sclera.

Immediately behind the cornea we find a planar vertical diaphragm called the *iris*, whose central opening, the *pupil*, seems dark because it opens into the interior of the eyeball. This opening has the ability to widen or contract depending on the circumstances, to allow a greater or lesser number of light rays to pass into the eye. The iris is colored blue, brown, black, etc.

Usually, the iris is slightly covered by the upper eyelid, while it comes flush down to the free edge of the lower eyelid. In eyes that project from the orbit, it is not uncommon to see the iris bordered on the bottom by the white edge of the sclera, which separates it from the lower eyelid. Sometimes, the iris is completely surrounded by a white circle, which gives the face a strange effect as though the person is frightened.

4. Nose

By its uppermost part, the nose is in direct continuity with the forehead (Figure 43). In men, a consistent notch marks the root of the nose, caused by the projection of the lower part of the forehead along the median line at the nasal eminence. This indentation is clearly visible on the skeleton, and although it is often transformed into a depression by the projection of the eyebrows, it still maintains its form in the design of the root of the nose. In women, this notch is missing and its absence constitutes, with the verticality of the forehead, one of the most striking traits of her profile. The line of the forehead continues directly into the line of the nose, although this is not to say that the two lines follow the same direction. The line of the nose always rises ever so little, so as to describe with the line of the glabella an angle that is more or less obtuse and opens forward. It is only in the form conventionally adopted by Greek antiquity that one sees the bridge of the nose continue the direction of the forehead.

The nasal bones, which support the root and the bridge of the nose in its upper part, are continued by the pieces of cartilage that serve as the skeleton of the rest of the organ (Figure 44).

The base of the nose is free and faces downward.

I will not describe in detail the variations in shape of the bridge of the nose, or the differences in orientation of its base (Figure 45).

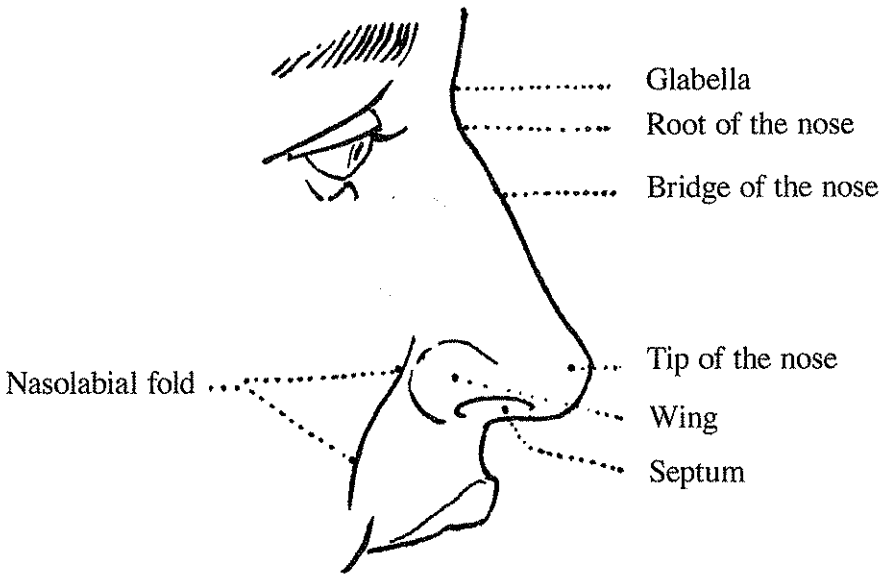


Figure 43: Conformation of the nose

The base of the nose is pierced by two openings called *nostrils,* which are separated by a *septum* in the center. The nostrils are oval shaped with the large end directed backwards. The septum attaches itself to the middle of the upper lip with a thicker part. The base of the nose is enlarged on the sides to form the wings of the nostrils. It has a bulge at its anterior extremity, which forms the tip of the nose.

The wings of the nostrils are circumscribed above and in back by a curvilinear crease that separates them from the rest of the nose and the cheeks. The nostrils open downward and outward, and it follows that the septum that separates them descends lower than the bottom edge of the nostrils. Hence, the nostrils always appear on a head seen in profile (Figure 43).

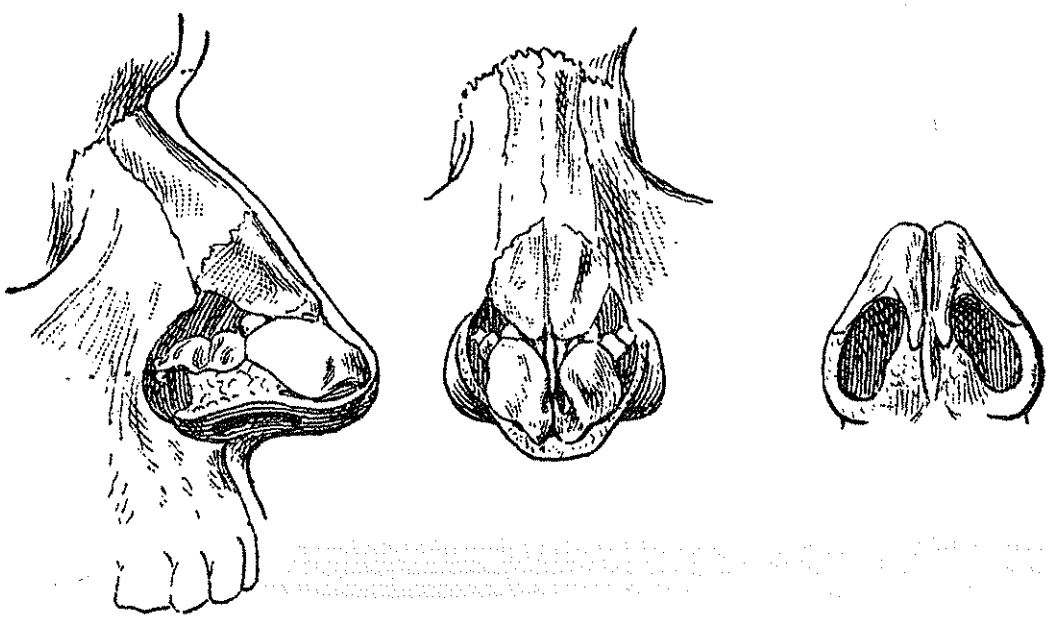


Figure 44: Cartilage segments that form the structural framework of the nose

The tip of the nose is sometimes evenly rounded, while other times it presents various planes determined by inflections of the cartilage that maintains its structure. It is not rare, on a thin and dry nose, to see the tip divide itself into two narrow projections separated by a light vertical trace due to the two cartilage pieces that surround the opening of the nostril on each side. The bridge of the nose is often marked by a slight bulge at the junction of the nasal bones and the cartilage.

The skin is thin around the root and bridge of the nose. Above the root, it is lined with a fairly thick cellular-fat layer that continues with the skin of the glabella, forehead and eyebrows. On the tip, as well as the wing of the nostril and the septum, it is very thick and adheres closely to the underlying layer. The sebaceous glands here are numerous, mainly on the tip and the wings of the nostrils, which often gives a shiny appearance to the skin in this region due to the fatty material that spreads onto its surface.

In women, the skin is much finer and rarely has a shiny appearance because it is less rich in sebaceous glands. The thin, delicate nose with fine and mobile nostrils and a dry tip modeled in planes is one of the attributes of the feminine face.

Figure 45 (right): Several profiles

A. Upturned nose
B. Long and straight nose; upper lip well rounded out.
C. Straight nose, vertical forehead
D. Convex forehead
E. Nose lightly hooked
F. Straight nose, upturned
G. Profile of a young peasant girl reminiscent of the Greek profile

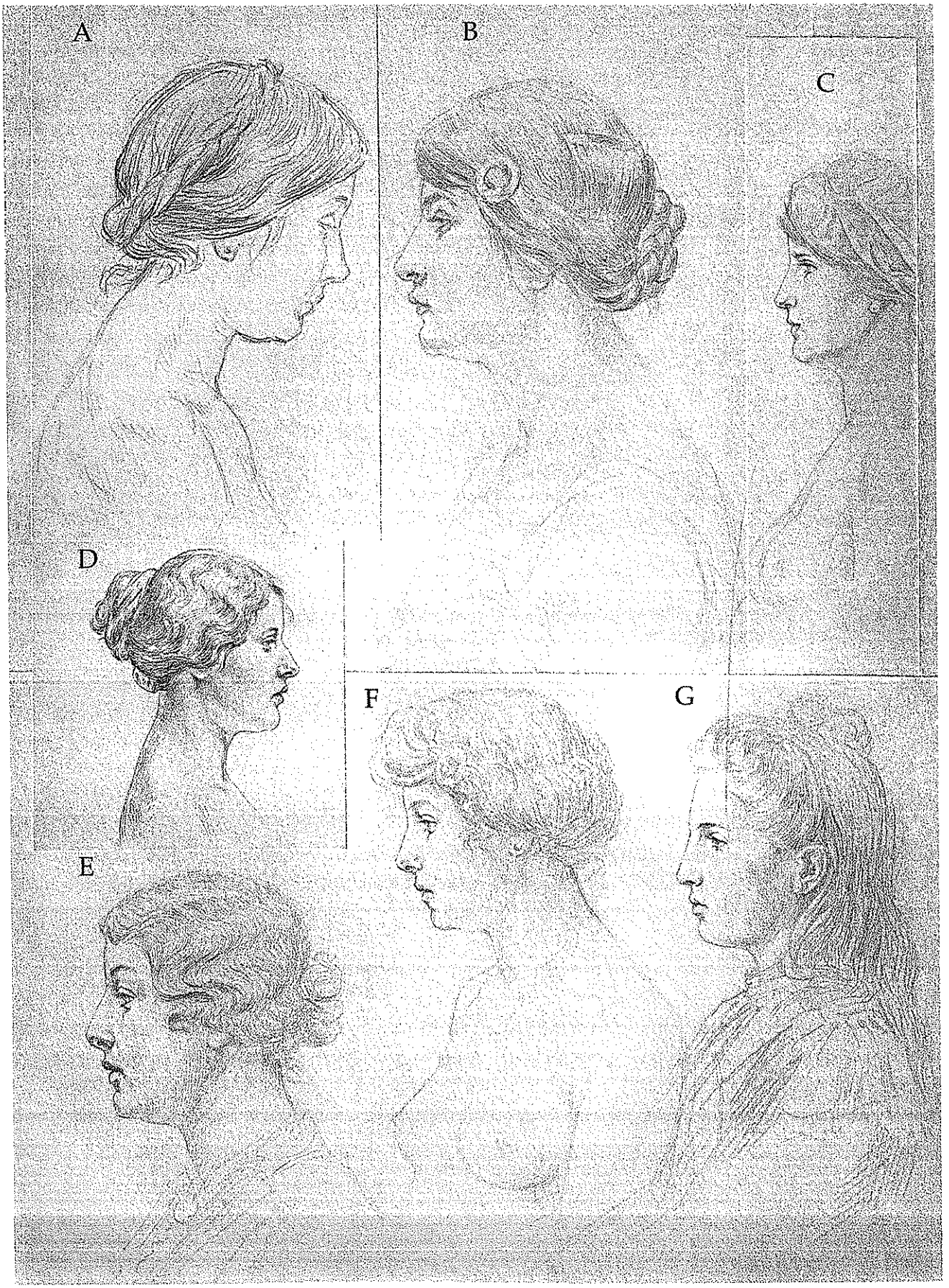


Figure 45: Several Profiles

5. Mouth

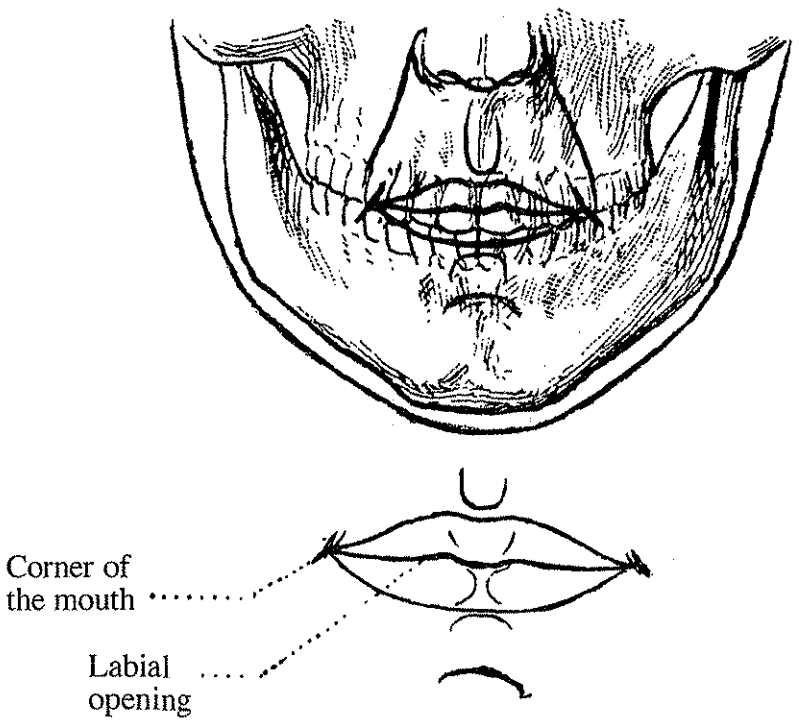


Figure 46: Conformation of the lips; relationship between the mouth and teeth

The mouth is surrounded by the lips, which rest on the projection of the dental arches. The meeting of the upper and lower teeth maintains the height of the lips, so when the teeth are missing, as happens in the elderly, the lips diminish in height and seem to turn into the mouth. It is worth noting that the only teeth that meet one another are the molars. The front teeth cross each other like the blades of a pair of scissors; the upper teeth descend in front of the lower. When the mouth is closed, the teeth make contact in back and cross in front. It has been said that when the lips are held together without effort, their line of contact corresponds approximately to the middle of the upper incisor (Figures 46, 47). Women's teeth are smaller, more regular, and have whiter enamel than those of men.

The upper lip has a median vertical furrow, the *philtrum*, carved out from it that rises to implant itself on the nasal septum. Another groove, which is shallower and wider, also exists below the lower lip and ends abruptly at the projection of the chin. This is the *mentolabial furrow*.

The red borders of the lips are formed by a mucous membrane. A projecting rim marks the place where this membrane unites with the skin; it stops at the contours of the lips. Regardless of the individual varieties in their shapes, the two lips always correspond to the basic forms of the upper and lower lips, determined by the phases of their development.

The upper lip is formed in three parts that join together in the first weeks of embryonic development: one central part and two lateral parts. (Their incomplete union causes a deformation called cleft palette). This is why the upper lip is composed of three parts: one central part, constituted by a rounded eminence that sits below the philtrum, and two lateral parts, in the shape of two symmetrical rolls which taper towards the corners of the mouth (Figure 46).

The lower lip is created by the union of two lateral forms along the median line, which takes place even before that of the upper lip. Thus, we see that it is formed of two symmetrical halves separated by a slight crease that persists as a trace of the embryonic formation. The double arc that gives the edge of the upper lip the appearance of a bracket corresponds to the lower lip with its one unique curve. The upper lip always projects over the lower lip. Regarding their thickness, it is highly variable according to the individual. One meets numerous different types in

nature, from lips that are very wide to thin lips that resemble a mouth carved by a stroke of the knife.

The lateral ends of the two lips taper and join each other to make the corners of the mouth. From the outside, two small cutaneous eminences shelter the corners of the mouth, and provide the site on which the nasolabial fold terminates (Figure 48).

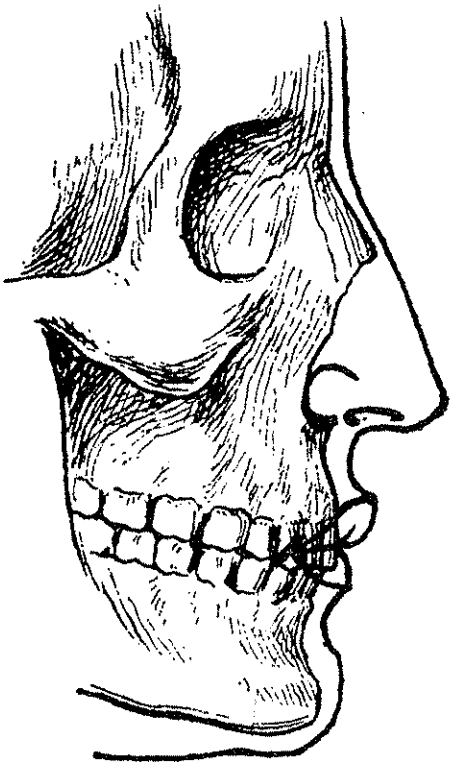


Figure 47: Relationship between the mouth and teeth, in profile

6. Chin

The chin completes the face from below. It makes a projection that is highly variable according to the individual: uniformly round on some, marked with a depression on the median line on others. This depression is due to the presence of a median raphe that joins the deep surface of the skin to the bone. The projection of the chin is a human trait and does not exist on monkeys. It is partly caused by the body of the mandible on which the chin rests, and partly by the accumulation of a rather dense fatty tissue that lines the skin here.

The top of the chin is clearly defined by the curved crease of the mentolabial furrow that separates it from the lower lip (Figure 48). The bottom of the chin is rounded, where it encroaches slightly on the underside of the jaw. It is separated from the throat by a transversal crease that may be deep or shallow, but which is constant and is never erased, no matter how heavy or slim an individual may be. This is the *inframental crease.* On those whose faces have accumulated large deposits of fat, this inframental crease clearly separates the chin from the transversal reliefs that take up the region below the chin, commonly called the double chin.

On the sides, the chin does not have such precise limits. In men, it enlarges before continuing into the lower edge of the cheeks. But, in women, it is generally narrower and forms the small end of the oval that represents the shape of the face as a whole.

7. Temples

The *temples* extend from the outer sides of the forehead. They correspond to the temporal fossa on the skeleton, although they do not convey its excavated shape except in grave circumstances when a subject is extremely thin. In the living, the temporal fossa is occupied by a powerful muscle that fills it and may extend slightly beyond the skeleton in both men and women. Thus, the shape of the region is always a bit rounded, especially in its upper part. It continues without interruption into the top of the head above. But in front, the temples are separated from the forehead by a curved projecting line corresponding to the bony relief of the external orbital ridge that borders the temporal fossa and continues into the upper edge of the cheekbones. Often very accentuated in men, it is also always observed in women. It separates the temple from the eye, and the horizontal projection of the zygomatic arch follows below it. In all of its lower part, above the zygomatic arch, the temple is a wide flat plane.

8. Cheek

The zygomatic bone continues into the zygomatic arch on its lateral side, which extends posteriorly and laterally. Together, the zygomatic bone, the zygomatic arch, and the mandible form the skeleton of this region, which plays an important morphological role here. In Asian individuals, a greater projection of the malar portion of the zygomatic bone, situated at the border between the front and the side planes of the head, gives the face a characteristic wide, flat aspect.

The zygomatic arch maintains the width of the face and, by the depression of its posterior root in front of the auditory canal, imprints the cheek with its transversal roundness.

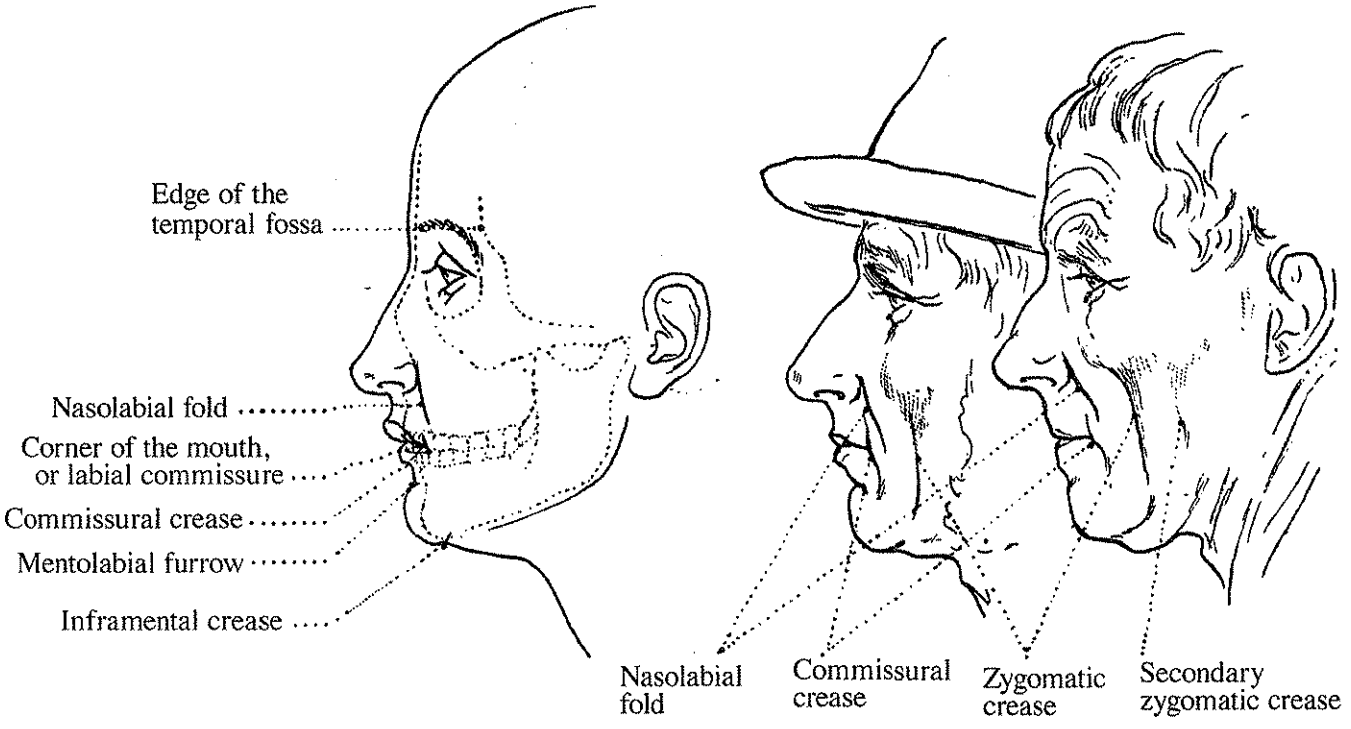


Figure 48: Creases of the face

The conformation of the entire lower half of the cheek is under the influence of the lower jaw, which is always smaller in women. This contributes to give her face its characteristic oval shape. In men, the development of the lower jaw, together with that of the masseter muscle, gives his face an angular, square shape.

The front of the cheek is separated from the lower eyelid by the nasal crease, and from the upper lip by the *nasolabial fold* (Figure 48). Between the two, the cheek rises diagonally to rejoin the side plane of the nose. A wide, shallow crease separates the region of the cheek from the nose.

The corner of the lower jaw supports the lower part of the cheek. It is separated from the neck by a rather wide, shallow groove that follows the anterior edge of the sternomastoid muscle. The angle of the lower jaw is variable in size. With age, the corner of the lower jaw is only visible on very thin people, but it is always important. By its degree of openness and by its relief, it has a great influence on the shape of the region.

In young people, the creases of the face are limited to those we have already mentioned: the nasolabial fold, the mentolabial furrow, and the inframental crease. But with the progress of age, other creases carve themselves into the cheek and are remarkable for their constancy. The *zygomatic crease* is the first to appear; it arises under the projection of the cheekbone and descends vertically until it sometimes rejoins the inframental crease. A second accessory crease may develop later, following the same direction, and perhaps come to join the zygomatic crease. This secondary crease is situated a short distance behind the zygomatic crease and cuts the middle of the cheek. These wrinkles grow with the years and appear mainly on thin faces. They are one of the first signs of the ravages of age, especially the zygomatic crease. And though they are less apparent on fatter people, a careful observation will easily reveal the first clues of their existence. These folds are a valuable guide for the modeling of the cheeks (Figure 48).

9. Ear

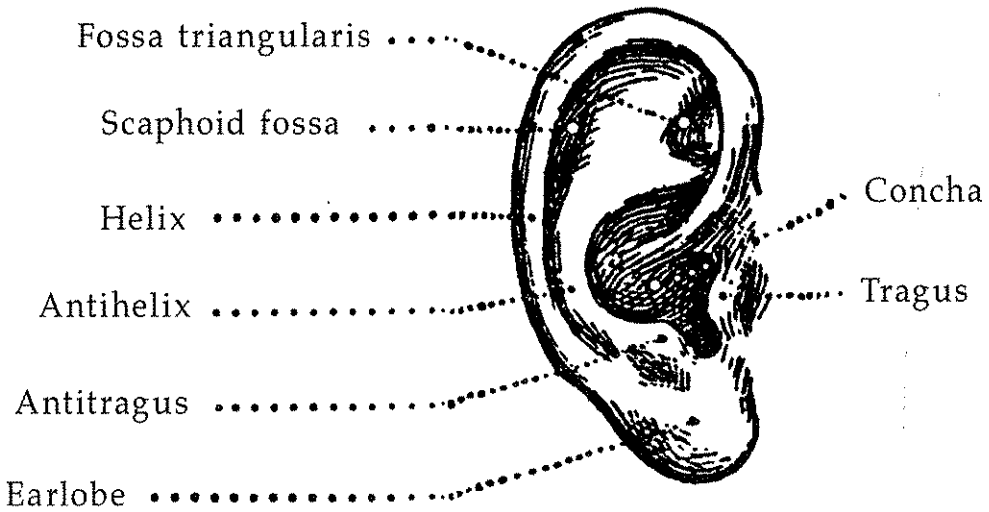


Figure 49: The outer ear

The outer ear is located at the intersection of the face, the cranium, and the neck. Generally speaking, it has an ovoid shape whose large end is turned upwards. The anterior third of the ear attaches to the side of the head. The rest of the ear sits on a plane that is between 1 and 1.5cm away from the skull, but which can sometimes be much further. Its major axis is not vertical; rather, it is slightly diagonal with its lower end tilted towards the chin, and its upper end towards the parietal eminence. Bertillon gives it dimensions of 6.2 cm long and 3.6 cm wide. In women it is smaller, but it must not fall below certain proportions. Its position is determined by the external auditory canal. And on the profile of a head whose face is vertical, it is generally situated between two parallel horizontal lines: one passing through the eyebrow, the other at the base of the nose.

The outer ear resembles a flattened horn along its major axis, whose wall is folded upon itself many times and offers a collection of unusual forms which vary considerably between individuals. These forms are described in the following fashion (Figure 49):

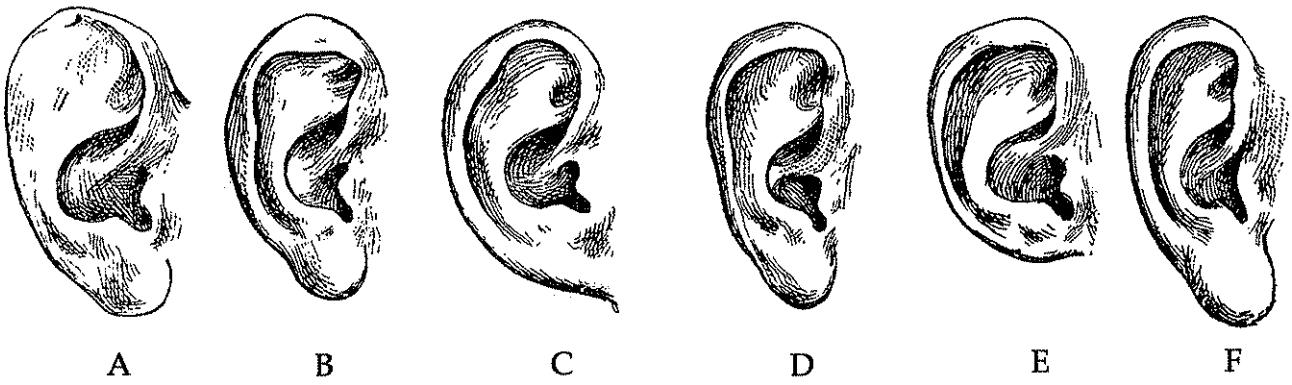


Figure 50: Several examples of an unusual conformation of the outer ear:

A. Unrolled helix
B. Unequal and flattened border
C. Attached earlobe
D. Divided concha
E. Lack of earlobe
F. Enlarged earlobe

In the center is a cavity, a kind of antechamber to the ear canal, which ends there. This is the *concha*. On the periphery, a fold borders the entire superior and posterior part of the ear, known as the *helix*. The anterior end of the helix starts at the bottom of the concha, above the auditory canal. It finishes at the *earlobe*, an ovoid fleshy mass that is free on both sides, and attached to the cheek only by the highest part of its anterior side.

The back of the cavity of the concha meets the *antihelix*. The top of the antihelix ends in two branches with a depression between them, known as the *fossa triangularis*. The helix and antihelix are often separated by an elongated cleft called the *scaphoid fossa*. Finally, two projections narrow the entrance to the concha, reducing it to a very characteristic notch: the *tragus*, which houses the entrance to the auditory canal, then, behind and below it, the *antitragus*, which terminates the antihelix.

This description represents the normal type, though there are many possible alterations to this form. Of these variations, the artist at least needs to know the principal ones, which are: the absence of the antihelix (unrolled helix), the absence of the earlobe or its enlargement, adherence of the whole earlobe to the cheek, an abnormal protrusion of the helix that divides the concha into two cavities, etc. (Figure 50).

The *subauricular depression* is hollowed out below the ear and behind the jaw. The projection of the mastoid process and its connection with the anterior side of the sternomastoid muscle sit just behind this depression. This very pronounced bony protrusion is separated from the ear by a deep groove that limits the attached portion of the organ and leads down to the depression behind the ear.

Figure 51: Diagram of the face, from Prof. Lanteri

10. Forms of the Face

I will conclude my description of the forms of the face with the illustration above (Figure 51), which I have borrowed from a very interesting work by Professor Lanteri.[38] It admirably summarizes the forms of the face. The masses indicated by these contours are not caused by any single anatomical element. The bones, the muscles, and also the skin will all contribute to create them. These are, in summary, mixed forms. Mr. Lanteri accompanies this illustration with the most insightful observations, revealing his profound understanding of the form.

"These forms," Lanteri said, "thus delineated, exist equally in women and men with a certain variety of design and in a more or less accentuated fashion. On the child's face, where they can seem to be missing completely, one can, when alerted to their presence, find them indicated by extremely delicate planes."

"On the face of an elderly person, they appear very clearly. If, on a face which seems to be very simple in shape so that the existence of these masses does not strike us, a strong light is placed in an oblique direction, it will reveal a variety of half-tones resulting from the planes or depressions which separate these forms on the model. By this procedure, we avoid those round, smooth shapes, which lack variety in modeling and are devoid of delicacy and expression."

[38] *Modeling and Sculpting the Human Figure: A guide for teachers and students*, by Edward Lanteri, 1902.

B. THE TORSO

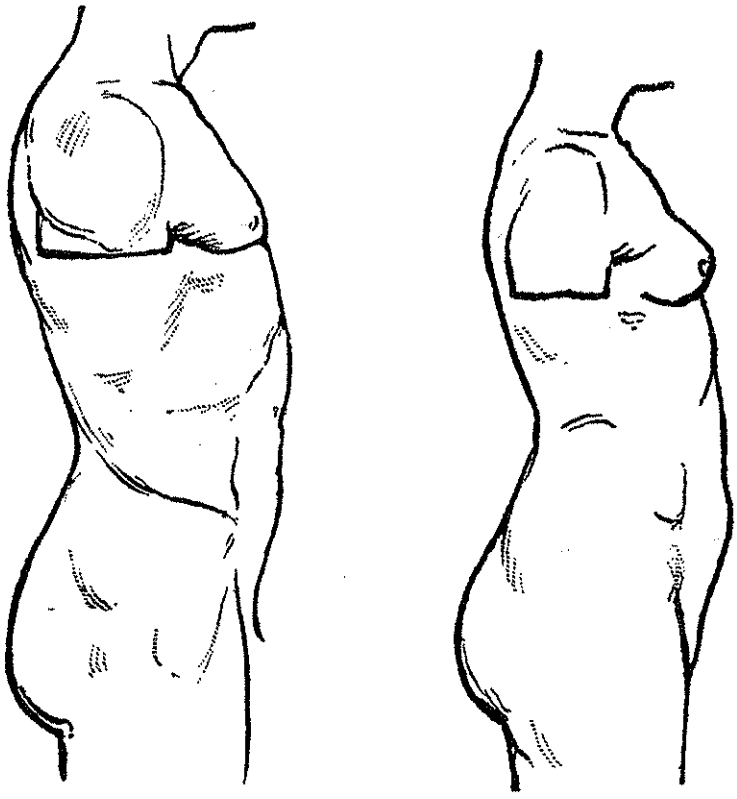


Figure 52: Diagrams of the male torso (thoracic type) and female torso (abdominal type).
Pelvis of average inclination for both, slightly more inclined in the female figure than the male.

The torsos of women and men differ in the unequal development and opposite direction of their upper and lower halves (Figure 52).

The masculine torso has more volume in its upper half, which makes it a thoracic type. The feminine torso, to the contrary, is associated with the abdominal type because of the development of its lower half.

The curvature of the lumbar arch is another differing characteristic. In women, it is accentuated because there tends to be more curvature in the lumbar spine and a greater tilt of the pelvis.

Now, I will remind the reader to consult Figures 28 and 29 devoted to the morphological topography comparing men and women. These will help to give an idea of the exact boundaries of the regions that will be discussed in this section.

1. Neck

The muscular framework of the neck is composed of the muscles of the nuchal region in back, and the sternomastoid muscles applied on top of several deep muscles on the sides. In women, the slenderness of the neck is due to a lesser development of muscle, since its general form is the same as it is for men: two lateral projections separated by a central depression that may be deep or shallow. For the same reason, the side plane of the sternomastoid muscle may not appear distinctly and can merge with the neighboring forms. It is only at its inferior

insertions that the sternomastoid is revealed: at the clavicle (flattened tendon), and especially at the sternum (rounded tendon) on either side of the suprasternal notch. Here, this muscle is visible under the skin as a singular form that is accentuated by movement; the full extent of the muscle becomes visible with the rotation of the head. At rest, the overall shape of the neck is almost uniformly rounded.

The front part of the neck, known as the throat, sees its morphology dominated less by muscles, which are only represented here by a few thin, flat units that mold themselves over the deeper parts (the sub-hyoid muscles). Instead, the shape of the front of the neck is determined by specialized organs which form a type of skeleton here. Their unequal development imparts a very distinct character on this part of the neck that is unique for each sex.

In effect, the wide empty space that exists on the skeleton between the mandible and the summit of the thorax is occupied in part by the upper passages of respiration (Figure 53: A, B). At the *hyoid bone*, which occupies the bottom of a crease separating the throat from the region under the lower jaw, we find the *larynx* suspended, to which the *trachea* is attached. Finally, the *thyroid gland* is applied over the entire upper part of the trachea. The larynx and thyroid are the two essential parts of the region.

The larynx, a cartilaginous apparatus where the voice is generated, has the appearance of a triangular pyramid. It is oriented so that the base is turned upwards and one of the sides faces towards the front. The top is truncated and rounded and meets the trachea. The edge of the base, directed forwards, is quite blunt and causes the projection known as the Adam's apple. This projection, which is found in all men but is variable among individuals, does not exist in women because of a lesser volume of the larynx.

The thyroid gland has a smooth surface and is formed by one narrow central part, a sort of bridge, which unites two voluminous lateral lobes, placed on the sides of the trachea, that climb up to the sides of the larynx.

Generally smaller in men, the thyroid hardly affects the exterior form, while by its greater development in women, it influences all of the morphology of the lower and front part of the neck. It is the cause of the enlargement and the rounded modeling just above the suprasternal notch in the woman's neck. This gentle bulge, whose morbid exaggeration constitutes goiter, follows the movements of the trachea and rises and falls in the movements of swallowing.

The modeling of this anterior part of the neck is therefore different in essence in the two sexes. In men, it is dominated by the angular projection of the larynx or the Adam's apple; in women, it is the soft and uniform relief of the thyroid gland that is most evident. To complete the morphology of the feminine neck, let us add the presence of several circular cutaneous flexion folds that seem to be an attribute of beauty since they are known as *the collar of Venus* (Figure 56).

At first glance, the neck seems longer in women than it does in men. This is due to a lesser volume of muscle, a more petite mandible, and often, to a descent of the shoulders. But in this respect, there are great individual variations that are caused by the displacement of the bony limits of the neck (Figure 54). Thus, at its upper limit, if the occipital bone constitutes a fixed form in back, then the mandible in front, according to the degree of its development, augments or diminishes the apparent height of the neck. It is the same with the lower limit, according to the variable position of the sternum, the clavicles, and the shoulders in general.

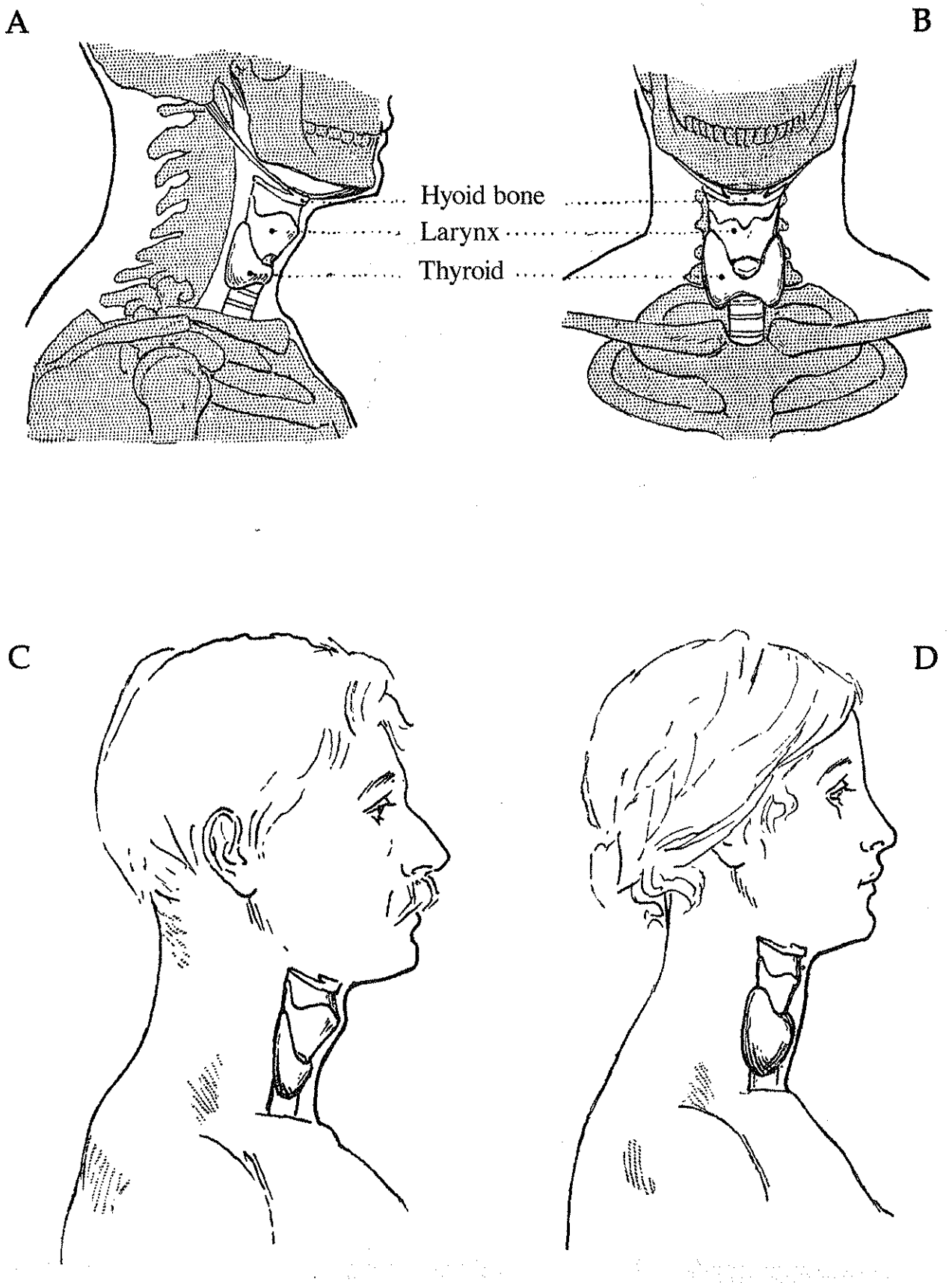


Figure 53: Framework of the neck in profile (A) and frontal view (B).

Hyoid bone, larynx, and thyroid in the male. Figures C and D show the opposite roles of the larynx and thyroid in the forms of the male and female neck.

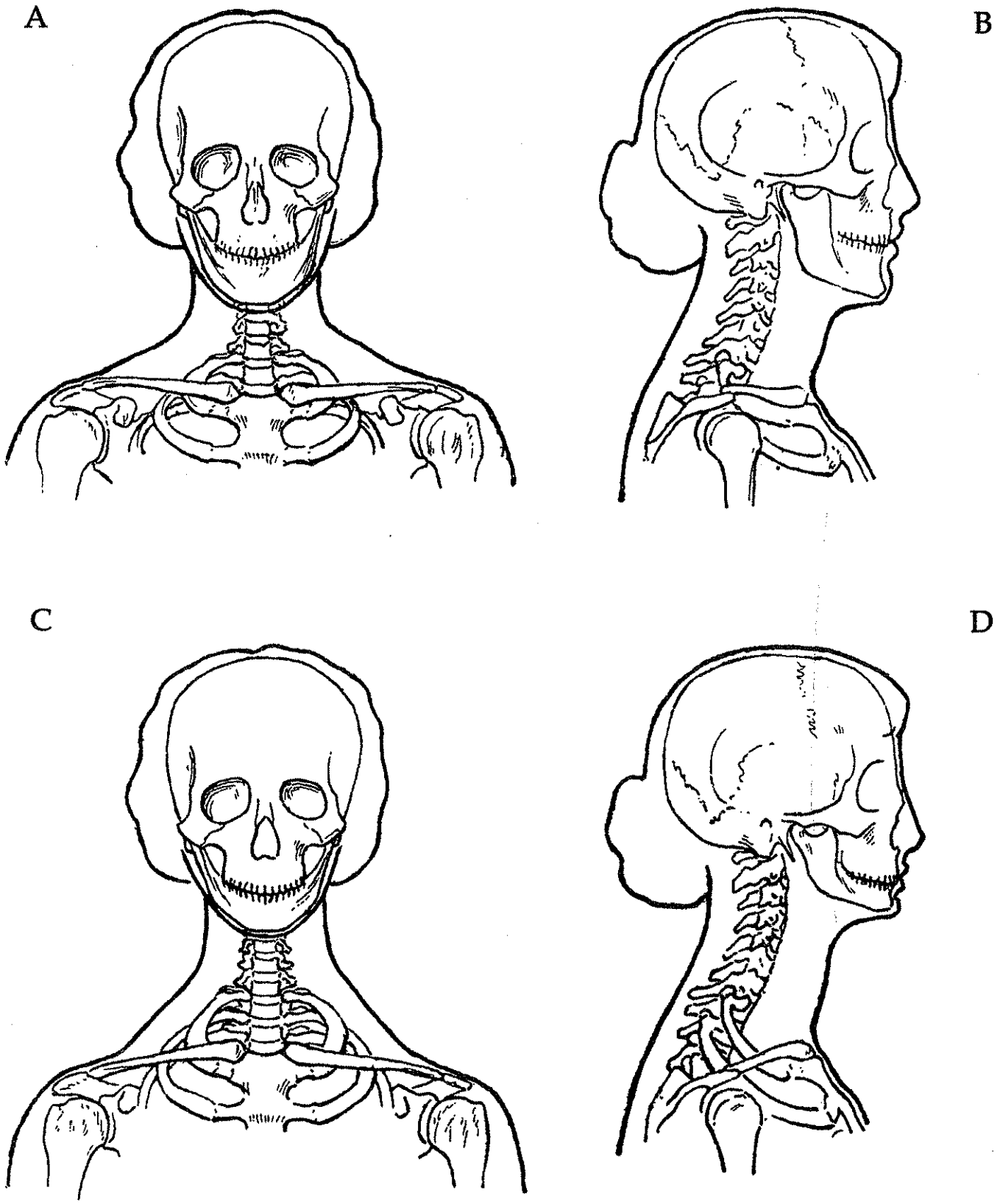


Figure 54: Diagram of a short neck (A, B), and a long neck (C, D).

In these two examples, the cervical spine is the same length. Only the bony limits of the neck are different: with a large mandible in A and B and a petite mandible in C and D. The sternum and clavicles are elevated in A and B, and lowered in C and D.

A long neck often coincides with a thorax that is rather depressed, clavicles that are angled downwards, and falling shoulders. This body type is often sought out by artists. The masters of the Renaissance generally accentuated these qualities; Albrecht Dürer always accompanied this physique with an exaggerated development of the trapezius.

When the neck is long and thin, its general direction follows that of the cervical spine (Figure 55: C, D). It is more or less curved with an anterior convexity, and it is this disposition that enables a poetic comparison between the neck of a woman and that of a swan.

It is worth mentioning that in the lower part of the woman's neck, the suprasternal notch is less deep than it is for a man. In addition, the lesser projection of the clavicles creates less definition of the supraclavicular fossa, which is variable in depth according to the amount of weight on the body and the position of the shoulders; elevation of the shoulders will augment the depth of the supraclavicular fossa. On the sides, the development of the trapezius and adjacent muscles produces an enlargement of the bottom of the neck in back which, on a subject seen from the front, draws two curved lines, convex and inclined, descending from the middle of the neck to the summit of the shoulder. This shape, which is constant on men even with little muscular development, is often replaced in women by a straight or even a concave line.

Finally, in back, we must mention a shape that is exclusively feminine. We know that in men, the oval aponeurosis of the trapezius makes a flat plane at the border between the neck and the back. The bony projection of the 7th cervical vertebra rises from the middle of this flat plane. In women, not always but often enough, and especially on those who have gained a bit of weight, the bony relief and the flat plane disappear under a swelling of uniform surface and rounded shape due to an accumulation of fat clearly localized here, which I have already mentioned above (Figure 22 and Figure 55, D).

Figure 55 (right): Masculine neck and several examples of feminine necks.

A. Very strong projection of the Adam's apple in the man

B. Convexity of the anterior side of the neck and absence of the Adam's apple in the woman; model 18 years old

C. The same features in another model with a longer neck, 17 years old

D. Long neck with the cervicodorsal fat deposit, 25 years old

E, F. Average proportions of the neck; one notices a slight projection of the larynx in E

G. Short neck

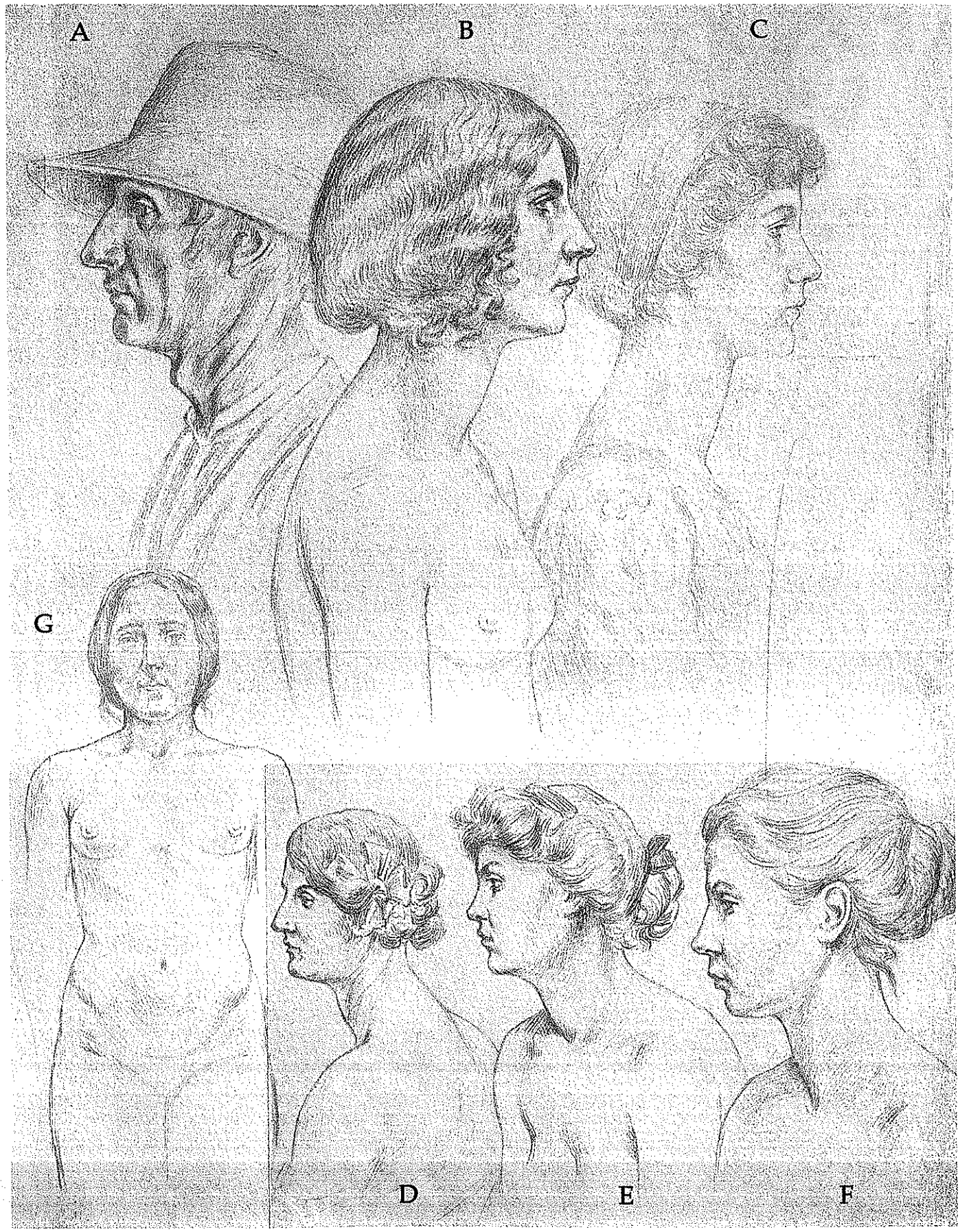


Figure 55: Masculine neck and several examples of feminine necks.

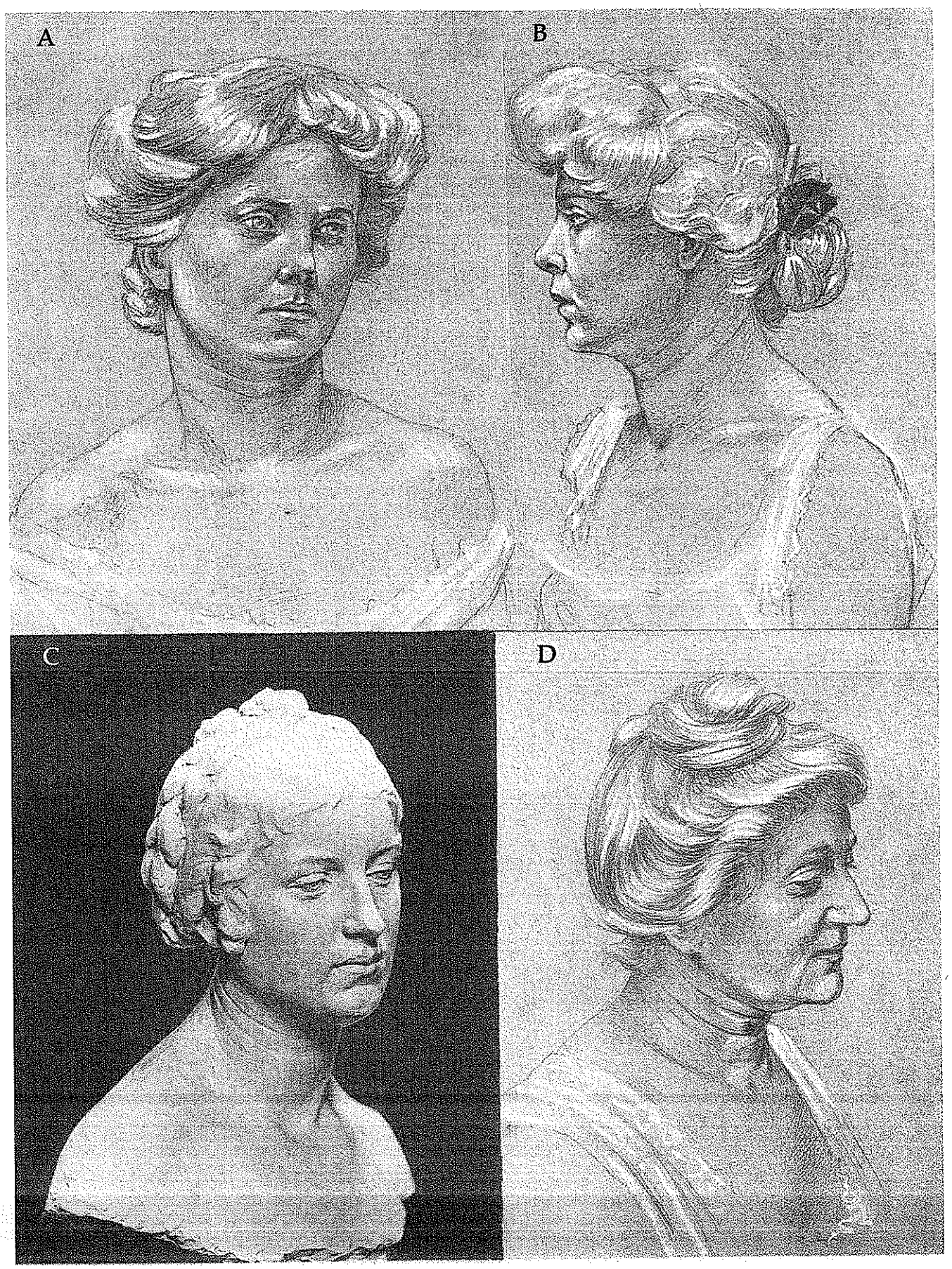


Figure 56: Collar of Venus

Figure 56 (left): Collar of Venus

A, B. Rather visible creases in a young girl, 19 years old

C. Very visible creases in a young girl, 18 years old

D. Creases in the neck of a woman of 47 years, having gained some weight previously and now becoming thinner.

2. Chest

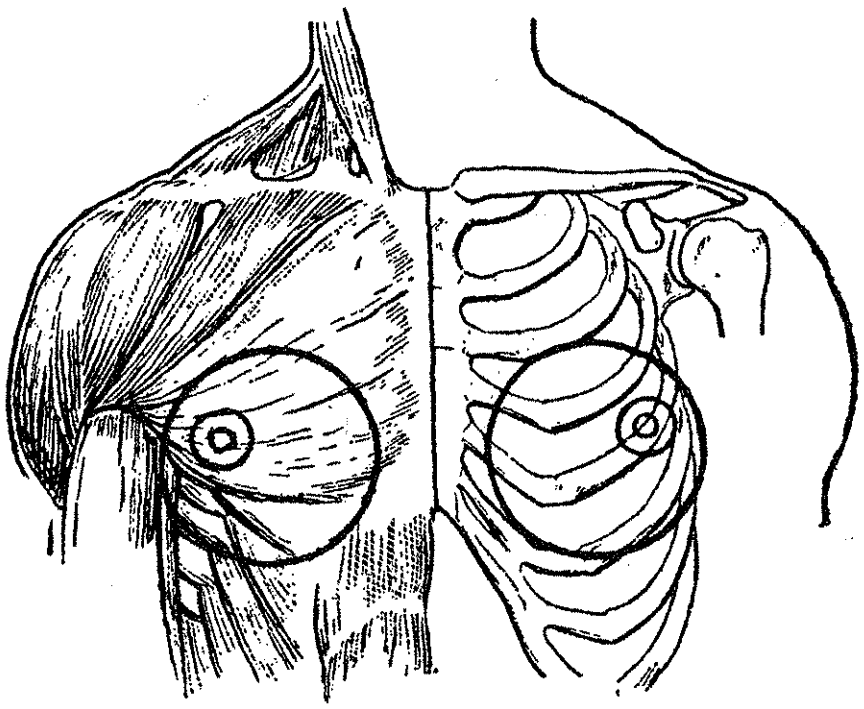


Figure 57: Anatomical placement of the breast

It is convenient to name thus, for women as well as men, not only the breasts, which one designates sometimes as the bosom, but the entire superior part of the torso corresponding to the front of the ribcage.

We have seen that in men, this region naturally subdivides itself into several secondary regions: in the center, the sternal region corresponding to the bone of the sternum, and on the side, two superimposed regions: the mammary region corresponding to the muscle of pectoralis major, and the inframammary region resting on the lower ribs. In women, there is no need to maintain these subdivisions. Even though it is possible to find them (see Figure 28), it is preferable to understand the entire height of the torso, corresponding to the front of the ribcage, with a single description.

The development of the breasts, which is one of the primary attributes of the feminine sex, should not make us forget the other morphological traits of the region. The breast, no matter what its shape, needs to be well placed and must be surrounded by corresponding details that are based on the structure of the chest itself.

The convex shape of the ovoid ribcage always reveals itself on the surface of the body, regardless of the thickness of the soft tissues that cover it. The most prominent point in front and at the top corresponds to the sternum, whose anterior convexity is always more accentuated in women.

The sternal angle, which corresponds to the union of the first part of the sternum with the second, draws a blunt transversal ridge that divides the region into two inclined planes. The upper part, bordered by the suprasternal notch above, blends into the neighboring regions on either side without a precise line of demarcation. The other, situated below, descends between the two breasts to arrive at the infrasternal notch.

The shapes of the ribs sometimes appear, especially on thin subjects, on the sides of the lower part of the ribcage (the inframammary region). The projection of the costal cartilage meets this region on the medial side. In the upper half of the torso, a powerful muscle, the pectoralis major, lies between the skin and the ribcage. Thus, the relief of the ribs may only appear discreetly near the sternum. In the rest of the region, in effect, the increasing thickness of this muscle dominates the form and makes a powerful relief at its lower edge and around the arm, which forms the anterior side of the armpit.

It is from these foundations (Figure 57) that the breast arises, extending from the third to the seventh rib, which is to say, resting on the fourth, fifth, and the sixth, overlapping the pectoralis major below, and oriented in a direction intermediate to the anterior and lateral planes of the ribcage. The nipple is found around the middle of the projection, at the meeting place of the two planes, and turned upwards. It sits closer to the upper part of the breast than it does to the lower edge. The breasts are separated by a space of a few fingers' width on the median line, which diminishes in size with the augmentation of their volume.

A valley that may be wide or narrow descends between the two breasts until the infrasternal notch, which it joins and enlarges, and there terminates in a soft slope. Here, sometimes a true hollow occurs at the lower extremity of the sternum that disrupts the harmony of the region. When this malformation is very accentuated, as seen in Figure 58, the artist would not be mistaken to see the thorax as funnel-shaped, which one calls this special deformation. It can exist in all degrees of moderation, and can be recognized on some professional models (Figure 59: E, F) who are otherwise well built. It seems interesting to instruct artists of this.

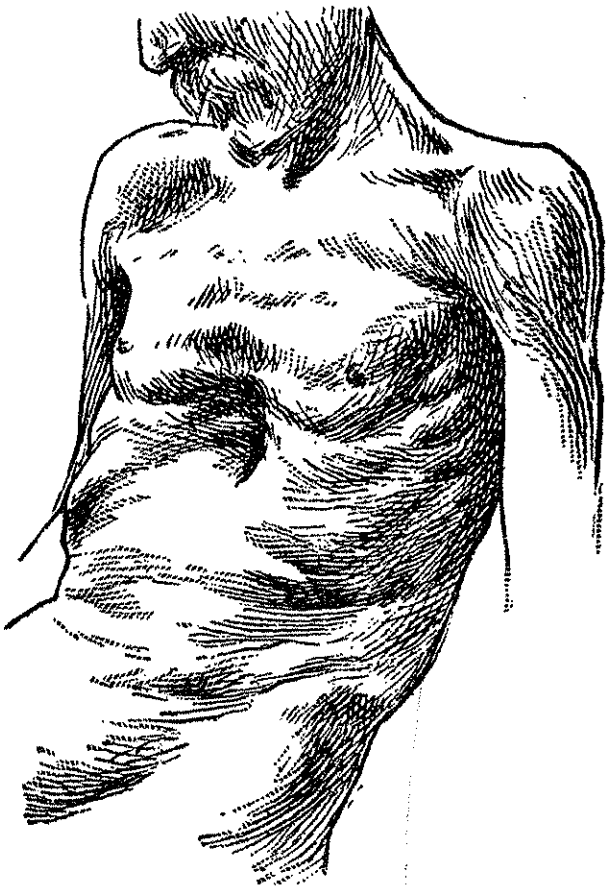


Figure 58: Funnel-shaped thorax in an old man

The breasts have to detach themselves cleanly from the plane that surrounds them. Above and to the outside of them, one always has to see the projection of the muscular bridge that extends between the thorax and the humerus, which constitutes the anterior side of the armpit. The breast should never be separated from the shoulder by a valley; this could only be an indication of an excessive paucity of muscle.

The highly variable shapes of the breasts can be divided into two types: the hemispheric and the conic (Figure 59).

The hemispheric shape is most common among Europeans. But the hemisphere is never of a geometric regularity, the lower half being more accentuated than the upper half. Even on a small breast with little volume, young and firm, one observes that in profile, the convex curve below the breast is very low-slung, while above the breast, the contour may even be slightly concave.

The nipple usually rests on an areola of brown coloration, making a slight projection. Great individual variations exist for this structure, just as they do for the volume of the breasts. Certain women have a big areola that projects strongly. The near complete absence of the areola is also equally observed.

The volume of the breast, as well as its shape, is not due solely to the presence of the mammary gland. The existence of a fatty tissue that surrounds the gland, as if to protect it, also plays an important role here. It is the abundance of fat that makes the breasts almost touch along the median line, augmenting their volume, and no longer separating them by a valley. The same cause makes the breasts heavy and drooping. Thus, a deep fold circumscribes them from below. On a well-shaped breast, this fold, while always being more accentuated than that which defines the breast from above, is always superficial and largely open. If, on a large breast, the crease that separates it from the inframammary region is always accentuated with the accumulation of fat, its other limits to the contrary tend to disappear. It is submerged, so to speak, in the fat of the neighboring regions. Above, its surface continues with that of the chest; from the outside, it covers the projection of pectoralis major and extends into the armpit.

The fat deposit of the breast is perhaps one of the most variable of all those that are present in women, and it often escapes the law that governs the others. Thus, it is not rare to see young girls, in whom all the fat deposits are absent or only slightly developed, present very voluminous breasts, while others of mature age, with of an abundant layer of fat tissue throughout, have very small breasts.

The placement of the breast is not maintained by any rigid anatomical arrangement, from which it follows that great variations exist in its position (Figure 60). There are some women who have their breasts placed high, and others to the contrary who have them situated rather low, even if they may not be voluminous. Fashion even melds them together sometimes. In the Renaissance, it was fashionable to have small breasts on a thin chest, spaced far apart and very high, almost right below the clavicle. I do not know how the women of that time could have realized these forms. It is likely, then as now, that nature herself continues to play the primary role, and that many have to resign themselves not to follow the fashion. Because it is always possible to augment an absence of form under your clothing, but no artifice can hide or hinder an abundance of form. Nonetheless, the artists of that era have left many curious specimens of this ideal in their work.

Figure 59 (right): Well-shaped breasts of varying volumes.
A, B, E. Hemispheric breasts
C. Conic breasts
D, F. Funnel-shaped thorax in a young girl of 14.

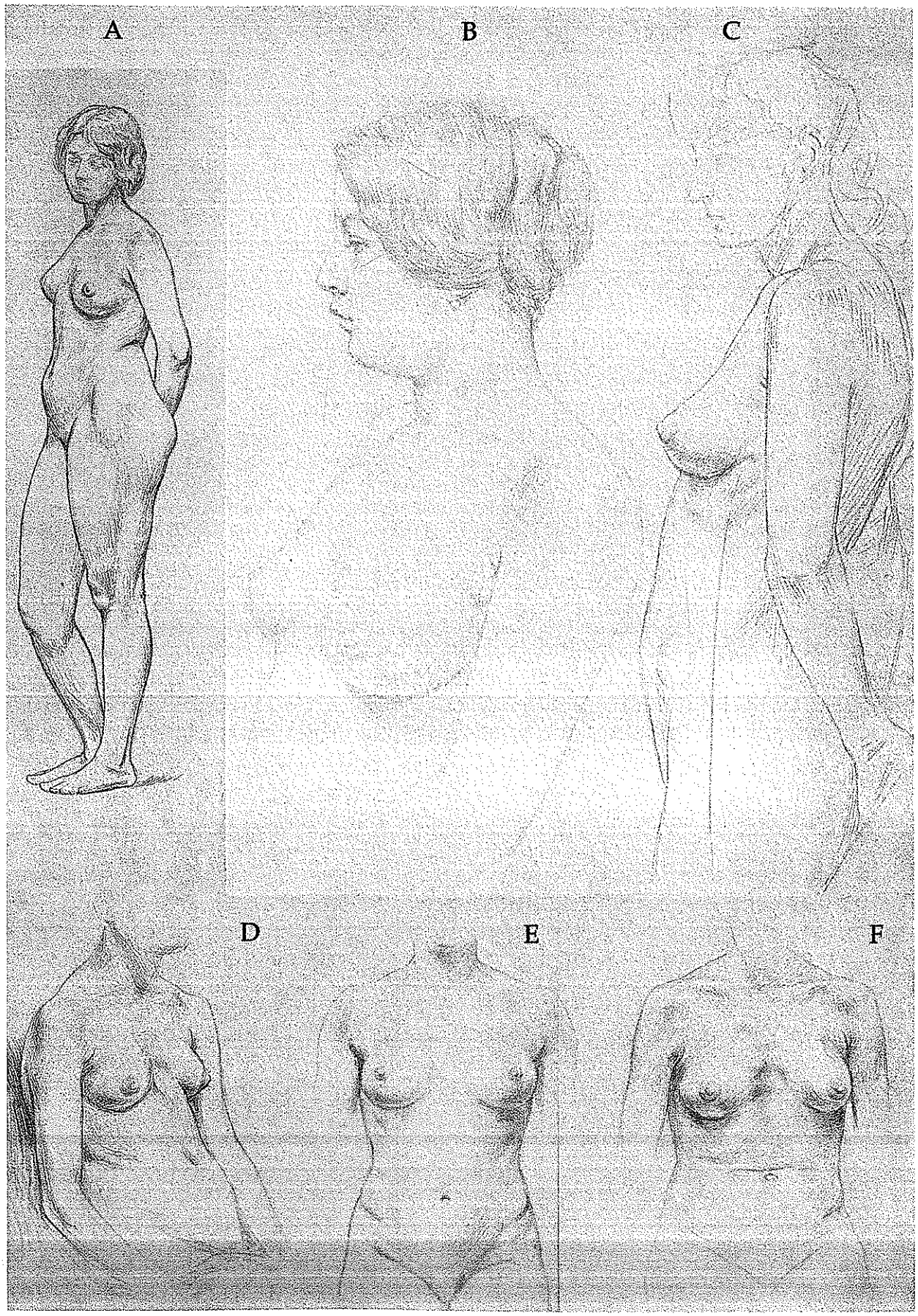


Figure 59: Well-shaped breasts of varying volumes.

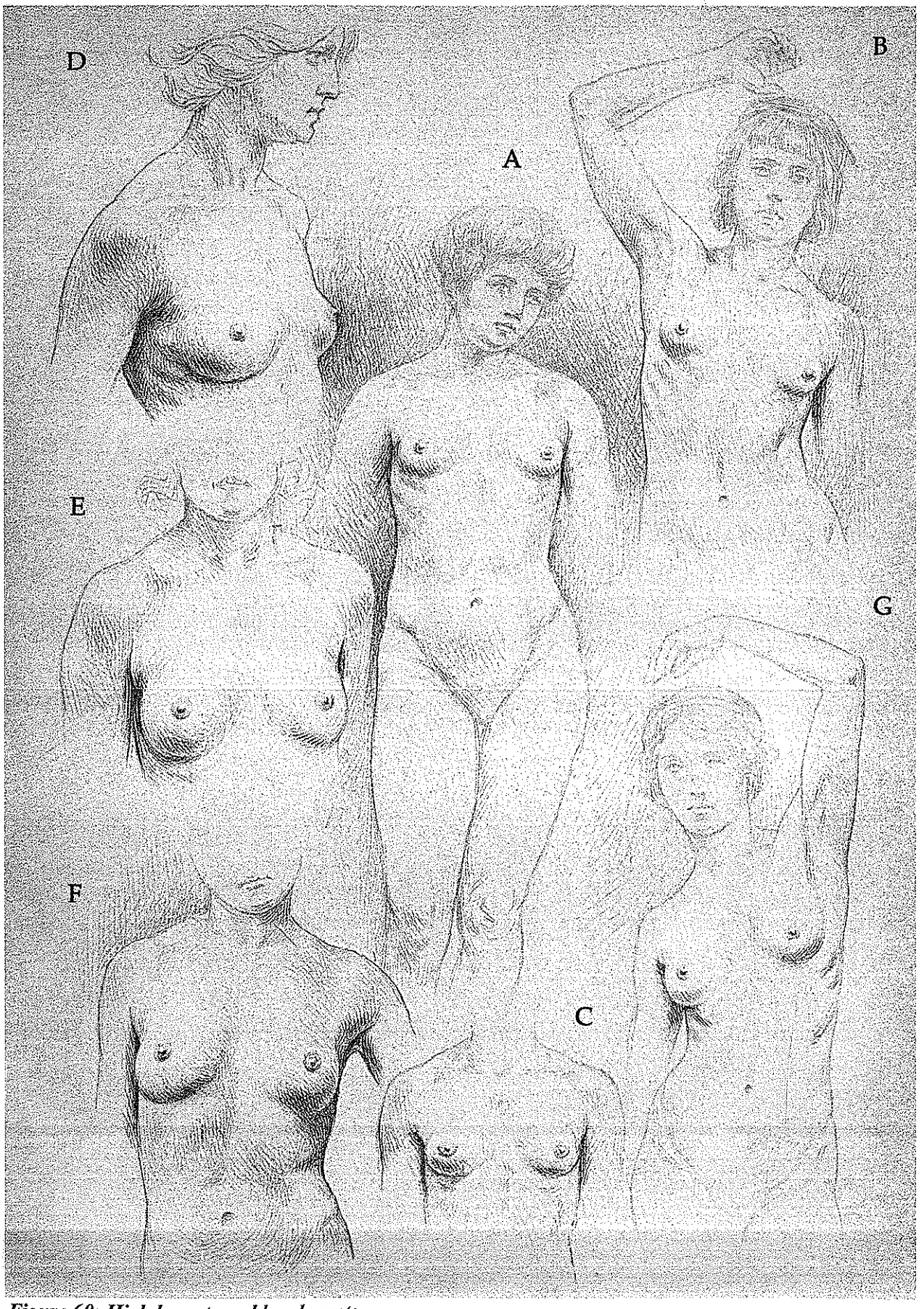


Figure 60: High breasts and low breasts

3. Shoulder

Rounded in shape, the shoulders extend beyond the acromion process. One single muscle occupies the region: the deltoid, itself supported by the head of the humerus. It begins along the pectoro-deltoid fold in front, then blends with no precise limits into the scapular region in back, where the posterior third of the muscle is attached. Projecting in front, flattened in back, the shoulder is always marked by a depression on the lateral side at the bottom of the deltoid's insertion. The constancy of this point is due to the adherence of the skin with the deep tissues here, in spite of a rather large quantity of fat that softens the bumps of the écorché.

In women whose skin is lined with even a moderate panniculus adiposus, the shoulder only shows softened, curved surfaces from all sides, which attach themselves imperceptibly to the neighboring parts.

The shoulder is only connected to the ribcage by a single fixed point: at the articulation of the medial end of the clavicle with the sternum. The scapula is only held onto the posterior surface of the ribcage by the muscles that are inserted there. Thus, the normal position of the shoulder is determined by the combined tonic forces of all the muscles of the region. To this effect, weakening the upper half of the trapezius and levator scapulae will cause a lowering of the shoulder, while their exaggerated development will produce an opposite result.

The weakness of the lower part of the trapezius and the latissimus dorsi will round the back transversally, hollowing out the chest and making the clavicles project forward to advance the roots of the arms. The tonic predominance of pectoralis major and serratus anterior will create the same result.

The normal position of the shoulder is due to a happy equilibrium of the muscular forces that is translated in the following way:

The clavicle is horizontal and, on a profile view, the top of the shoulder is situated just at the middle of a horizontal line that passes through the sternal angle. In a very muscular man, the lateral end of the clavicle rises, so it becomes inclined upwards and to the outside. In women, the clavicle may tilt in the opposite direction if there is weak muscular development. The accentuation of this disposition leads to sloping shoulders, which are a special attribute of the figures of the Renaissance. One of the consequences of this posture is to reduce the supraclavicular fossa, which tends to disappear even on subjects with little body fat. Removing this depression adds to the harmony of line and the fullness and convexity of surfaces. In the opposite case, when the shoulders are high, which one finds rather often on models, the impression of the whole can be described by the expression *épaules en porte-manteau.*[39] The clavicles are strongly oblique upwards and to the outside, adding to the depth of the supraclavicular fossa. The neck thus becomes short, yet when the shoulders fall, it gains in height because of the reasons I have given above (see p. 117, 119).

Very rarely are the two shoulders situated exactly at the same level. One shoulder is almost always higher than the other; most often, it is the right.

Figure 60 (left): High breasts and low breasts

A, B, C. High breasts

D, E, F. Low breasts

B,G. The rising of the breast on the side of the raised arm; armpit visible

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[39] 'coat-hanger shoulders'

4. Armpit

When the arm falls naturally alongside the body, the armpit has the shape of a very deep crease in the anterior-posterior direction. It is only when the arm separates itself from the torso that this fold enlarges to become the cavity of the armpit, around which one distinguishes four borders. The upper and lower borders continue into the neighboring regions without lines of demarcation: the upper border with the arm, the lower border with the thorax. But the two other sides form actual ledges, as a sort of jetty thrown between the thorax and the upper limb. The anterior wall, thick and rounded, is formed by a winding of the superficial and deep musculature of the pectoralis major. The posterior wall, which descends lower, is formed by the teres major lying underneath the outer corner of latissimus dorsi before its insertion on the humerus. Because of the inequality of length of these two borders, the armpit opens forwards and to the outside, and does not appear on a figure seen from the back.

In the vertical elevation of the arm, the armpit changes in shape (Figure 60, G). In this position, it becomes a large vertical groove, bordered in front by pectoralis major and in back by latissimus dorsi and teres major. This groove leads up to the cylindrical form of corocobrachialis, which is generally very distinct. Here, the groove bifurcates and corocobrachialis passes between its two branches, which separate it from the neighboring muscles.

It is worth mentioning again that the oblique groove, which starts from the armpit, travels down and backward, passing around the root of the upper limb and separating teres major from the triceps first, then from the posterior segment of the deltoid.

In this position, the armpit encroaches on the anterior side of the torso and finds itself in a plane facing obliquely forwards and laterally.

No region is as variable in appearance as the armpit, since it changes constantly with the various movements of the upper limb. But, it will always be easy to recognize the muscular swellings that I have described, even in women. These forms are the best guides to the proper representation of the region. Indeed, the armpit is only rarely masked by the accumulation of fat. Its form is maintained by the presence of very strong aponeurotic fascia that attaches the deep surface of the skin to the skeleton in this region. This makes a sort of vertical partition oriented in the anterior-posterior direction.

Even in women, the crease of the armpit may contain several tufts of hair that can more or less mask its shape, but which it is not useful to represent in the arts.

5. Abdomen

The infrasternal notch of the thorax sits above the abdomen. This notch lies between the costal cartilage and makes an open angle facing downwards, whose summit is at the base of the xiphoid process. This angle is always acute in women, but it should not be less than 60°, which is average. (See xiphoid angle, page 56.)

In the living, the highest part of the rectus abdominus muscle fills this angle. In women, the edges of the false ribs, which connect to the costal cartilage, have very subtle forms; they do not really reveal themselves except on very thin subjects. However, the apex of the xiphoid angle is always marked on the nude by the depression of the infrasternal notch.

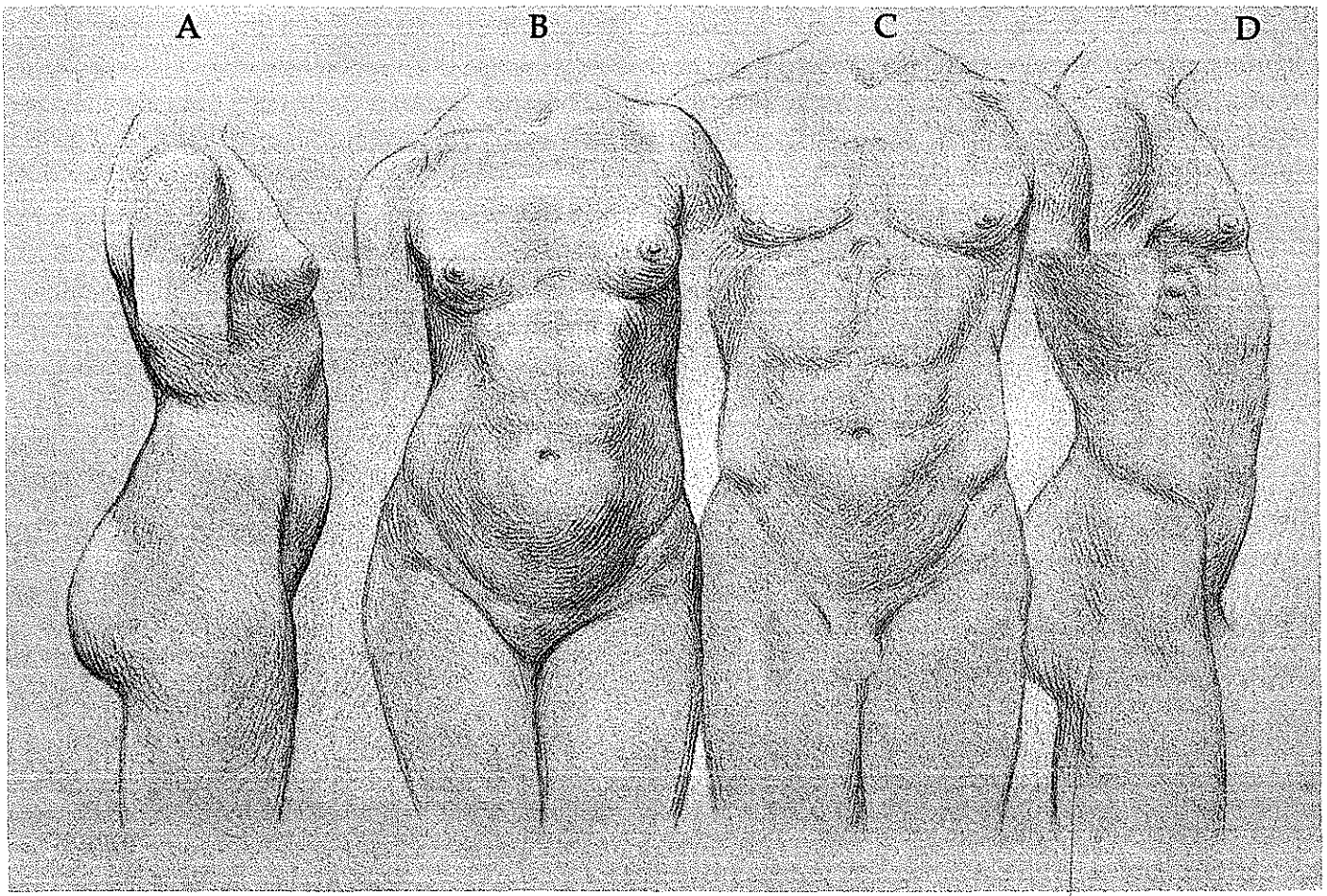

Figure 61: Drawings comparing the feminine and masculine abdominal region, from the front and the profile. *One finds the same muscular forms on both. The most pronounced difference is the greater projection of the hypogastric region in women due to the fat present there.*

This depression is essentially due to the spreading of the two halves of the rectus abdominus. Joined until this point, they divide along the median line toward their superior insertions on the thorax. The infrasternal notch gives rise to the median furrow of the abdomen, which is caused equally by the reliefs of the same neighboring muscles. Thus, the infrasternal notch has an imprecise lower limit. In contrast, its upper limit has a rather accentuated curved rim due to a ligament in the costal arch that unites the cartilages of the last ribs in front of the xiphoid process, which is located deeper behind it. These traits, clearly defined in men, persist nevertheless in women, though more moderately. The infrasternal notch must always be clearly felt, even in women, because it is only under an excessive layer of fat that it occasionally disappears.

The central groove that runs through the whole height of the belly is accentuated differently at various points along its route and disappears completely below the navel.

The navel, a scar left from the detachment of the umbilical cord, is located approximately equidistant between the tip of the xiphoid process, which hardly reveals itself except to the touch, and the pubis. In animals, the navel is near the pubis, so that a navel placed high in the human species can only be a sign of good conformation. The navel should be hollow; in women, its depth is further accentuated by the normal accumulation of fat in the region. The shape of the navel varies. Most often, it is rounded with a rather sharp upper edge formed by a fold of skin. The navel is more accentuated when it is deep. Its lower edge is connected to the most projecting part of the abdomen by a

continuous plane. The navel can also be elongated from top to bottom. But its defining character is to be cleanly indicated and not have any raised part in its center, whether regular or irregular. This indicates a defect in the healing process and is often the first manifestation of an umbilical hernia. This abnormality of the navel is not uncommon in models, and artists, attracted by the allure of the unexpected or wanting to follow nature as closely as possible, have only too often reproduced it in their works.

On the sides of the median line, one observes the plane of the rectus abdominus whose aponeurotic intersections are seen very easily on men with even slight muscular development. These intersections are generally three in number. The artists of antiquity regularized them by dividing the surface of the muscle into schematic quadrilateral planes. The lowest intersection is found at the level of the navel; the highest is a few fingers' width from the infrasternal notch, and the middle is an equal distance between the two.

This anatomical disposition is especially visible in men, yet it is equally significant in women, and the artist who is aware will easily find it.

The lower border of the abdomen is defined by a curved crease. On the sides, it meets the anterior edge of the iliac bones, where it forms the crease of the groin. On the median line, the abdomen ends above the pubis. I will return to the morphology of this region later when I treat the forms that are influenced by the pelvis.

The abdomen is separated from the flanks by the *linea semilunaris*, which is especially visible on men, yet it also exists on women to a more moderate degree. It indicates the change in plane from the abdominal muscles to the muscles of the flank and the lateral surface of the ribcage.

The volume and the projection of the abdomen varies with the degree of weight of the subject, because we know that it is one of the primary places for the accumulation of fat. But, even without excessive weight, the abdomen is always the site of fat deposits, distributed differently in men and women, that imprint a very specific shape to each of the sexes. It is most easily observed in profile (Figure 18 and Figure 61).

In men, the panniculus adiposus is most abundant in the area above the navel, where we therefore observe the greatest projection. In women, however, fat has a preference to accumulate below the navel, accentuating the relief of this area which is so characteristic of the feminine abdomen. This same region is often the site of a median depression that accentuates the contour below the navel and is located approximately halfway between the navel and the pubis.

When there is forward flexion of the torso, one observes a superficial transverse fold in the skin just above the navel. Another semi-circular cutaneous fold of upward concavity is situated a few finger's width above the pubis. Its ends seem to come from the anterior superior iliac spines. This fold cannot be the consequence of the accumulation of fat in the region because we also find it in men and in subjects who are very lean. It is, rather, a secondary flexion fold.

The abdomen is proportionally larger in women than men. Measuring from the base of the xiphoid process to the upper edge of the pubis, Charpy found it to be 34 cm in women and 33 cm in men. The navel divides this length into two unequal parts. The upper part, the epigastric region, is approximately equal in both sexes. It is in the lower part, the hypogastric, where the differences result. The epigastric is 18 cm, while the hypogastric is 14.7 cm in a man and 15.4 cm in a woman. It follows that women have the navel positioned slightly higher than men do.

The width of the abdomen is measured by the bi-iliac external diameter. According to Charpy, it would be 29 cm in men and 28 cm in women. But according to my measurements, the width is clearly greater in women. I found the bi-iliac external diameter to be 28.78 cm in men and 30.10 cm in women.

It is hardly necessary to point out that women have a more slender waist. Quételet gives the following measurements for the diameter of the waist: 74 cm for men and 66 cm for women.

6. Flank

The flanks close the abdominal cavity on the sides and extend from the ribcage to the pelvis.

Here, I will repeat my description of this region in men[40]:

- The upper limit of the flank, while generally indistinct, is marked by a broad and superficial transverse line due to the change in direction of the external oblique. The upper part of this muscle is attached to the ribs; it detaches from them and bends outwards as it goes toward the iliac crest. This line, which begins from the costo-abdominal projection in front, ends with a depression in back, notable for its constancy, which corresponds to the inferior extremity of the thorax at the point below the last rib.
- The front of the flank is defined by the relief made by the insertion of the fleshy fibers of the external oblique on the abdominal aponeurosis, at the linea semilunaris. The back of the flank borders on the lumbar region.
- Below, it is circumscribed by the groove of the hip, or the *iliac line*. This name was given to it because of a misinterpretation by previous authors. Dr. Fau stated: "The iliac line corresponds to the crest of the ilium; we have already seen other examples of similar furrows made where the bony parts are very prominent..."

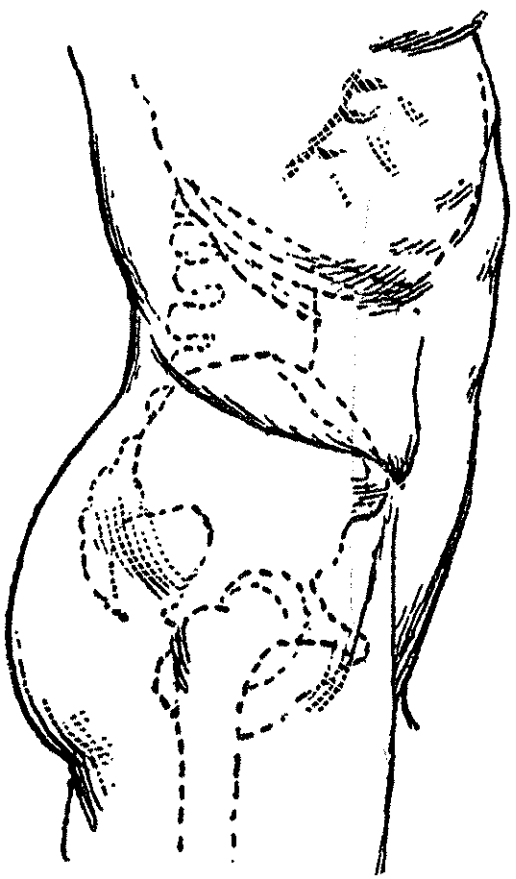

Figure 62: Discrepancy between the iliac line and the iliac crest.

This interpretation is far from expressing the truth. If the anterior third of the iliac line corresponds to the iliac crest, it is completely different for its posterior two-thirds, which is situated much lower than the peak of the iliac crest and creates a curve in the opposite direction. One sees the clearest evidence of this if one compares the profile of the pelvis to the profile of the nude (Figure 62). I will now mention the numerous anatomical reasons for this discrepancy.

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[40] *Anatomie Artistique*, p. 184 / Richer, Hale trans. p. 98

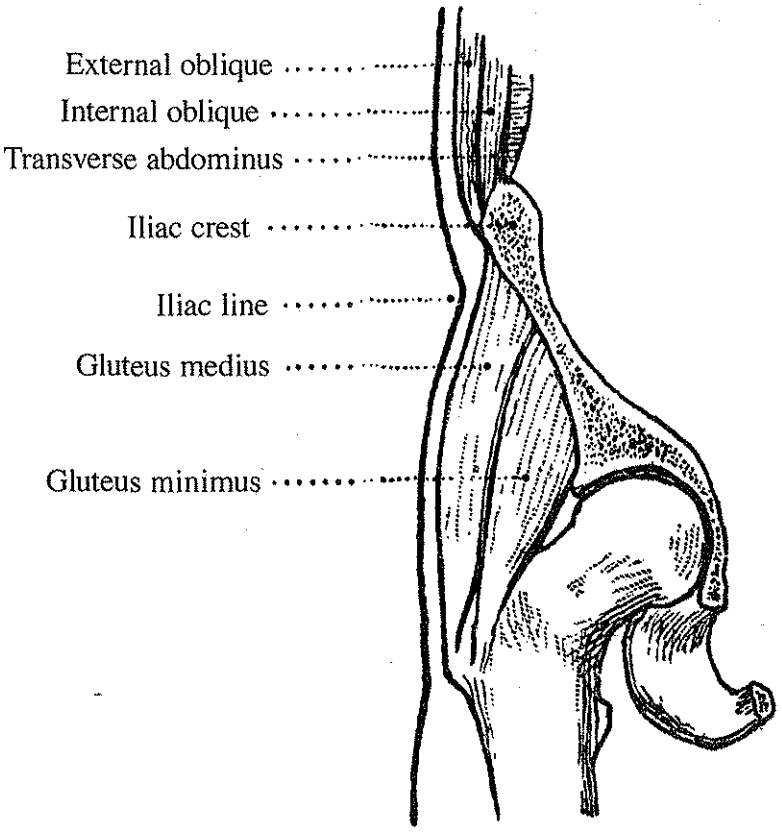

***Figure 63: Anatomy of the flank in a man's hip**: Vertical section from the middle of the iliac crest. Compare with a woman's hip in Figure 73, page 145.*

I will remind the reader that the iliac crest is very thick and has a rim along its upper edge, which rises significantly above the sides of the ilium to make a rounded surface with its outside edge lower than its inside edge. The lower fibers of the external oblique attach themselves to the outside of the lip of the ilium with very short aponeurotic fibers, so that the cutaneous fold that results from their relief is formed not only at the peak of the iliac crest, but also below it (Figure 63). It follows that this bony rim, which rises underneath the muscle, contributes to the projection of the flank much more than the muscle of the gluteus medius does. Since the gluteus medius is maintained by a very strong aponeurosis to the external iliac fossa, it cannot override this descent of the skin fold, whose direction follows a slight curve of downward convexity here. In addition, the consistent presence of a certain amount of fat at the posterior part of the flanks contributes to accentuate the descent of the skin fold.

In front, however, at the anterior third of the iliac crest, the bellies of the external oblique muscle move themselves away from the bone. They are also thinner and create less relief. Here, the bony crest is subcutaneous and the iliac furrow that corresponds to it describes a curve of upward convexity. The anterior superior iliac spine always makes a projection at the anterior end of this crease.

On a torso seen in profile, the iliac line takes the shape of a very elongated italic *S*, extending transversally.

The surface of the flanks is always convex in the transverse direction. It is also convex from top to bottom in muscular subjects, while the flanks can be concave in lean people, revealing the shape of the iliac crest. Basically, its

surface betrays the shape of the muscle of the region, external oblique, whose greatest projection is forwards at the abdomen and downwards at the hip. We must, however, introduce a new element to the posterior part of the region; this is the subcutaneous panniculus adiposus.

I have observed, on everyone, even on thin individuals, a thickening of the fatty layer that lines the skin at the posterior part of the flanks. The degree of this thickening is variable according to the individual, but is constant. When this thickening is slight, it limits itself to softening the relief of the posterior edge of the external oblique and filling the space which exists on the back of the écorché between the external oblique and the latissimus dorsi at their insertions on the ilium. But, in many cases, fat accumulates in this region and remains perfectly localized here, to the point of making a veritable pad on the back that continues the relief of the external oblique, which sits in front of it. I am not talking about fat individuals, in whom the pad is very developed. It also exists in people of moderate weight, and it makes an actual projection in back that continues until the lateral superior lumbar fossa, which may be partially filled by it.

In women, while the essential features of the region remain the same, two of its elements undergo specific developments that contribute to the special characteristics which distinguish the feminine flanks: an abundance of the fat pad and a widening of the iliac crest.

Indeed, the accumulation of fat, always greater in women than in men, fills the iliac line in back so that one can only find a superficial trace of it. Some fat also fills the lateral superior lumbar fossa, which disappears. This erases any barrier between the buttock and the flank by merging the fat of the two regions together. Thus, the buttock seems to rise until the fold of the waist, which is actually the superior groove of the flank, and is more accentuated in women than in men.

By bringing the iliac crests more outwards, the widening of the pelvis has the effect of diminishing the anterior half of the iliac line. This further contributes to emphasize the subtle quality of muscular development in the feminine physique due to the diminution of the external oblique (Figure 64).

Therefore, if the reliefs of the forms in this whole region are essentially the same in women and men, then they are rather diminished and more difficult to perceive in women. This justifies the eminently practical advice gathered in ateliers that, to understand the female body with her finer nuances, one must examine her both in artificial light and by raking daylight.

Figure 64 is designed to show the similarities and differences of this region in men and women. An intermediate type, which one sometimes encounters, serves as a transition between these two extreme forms.

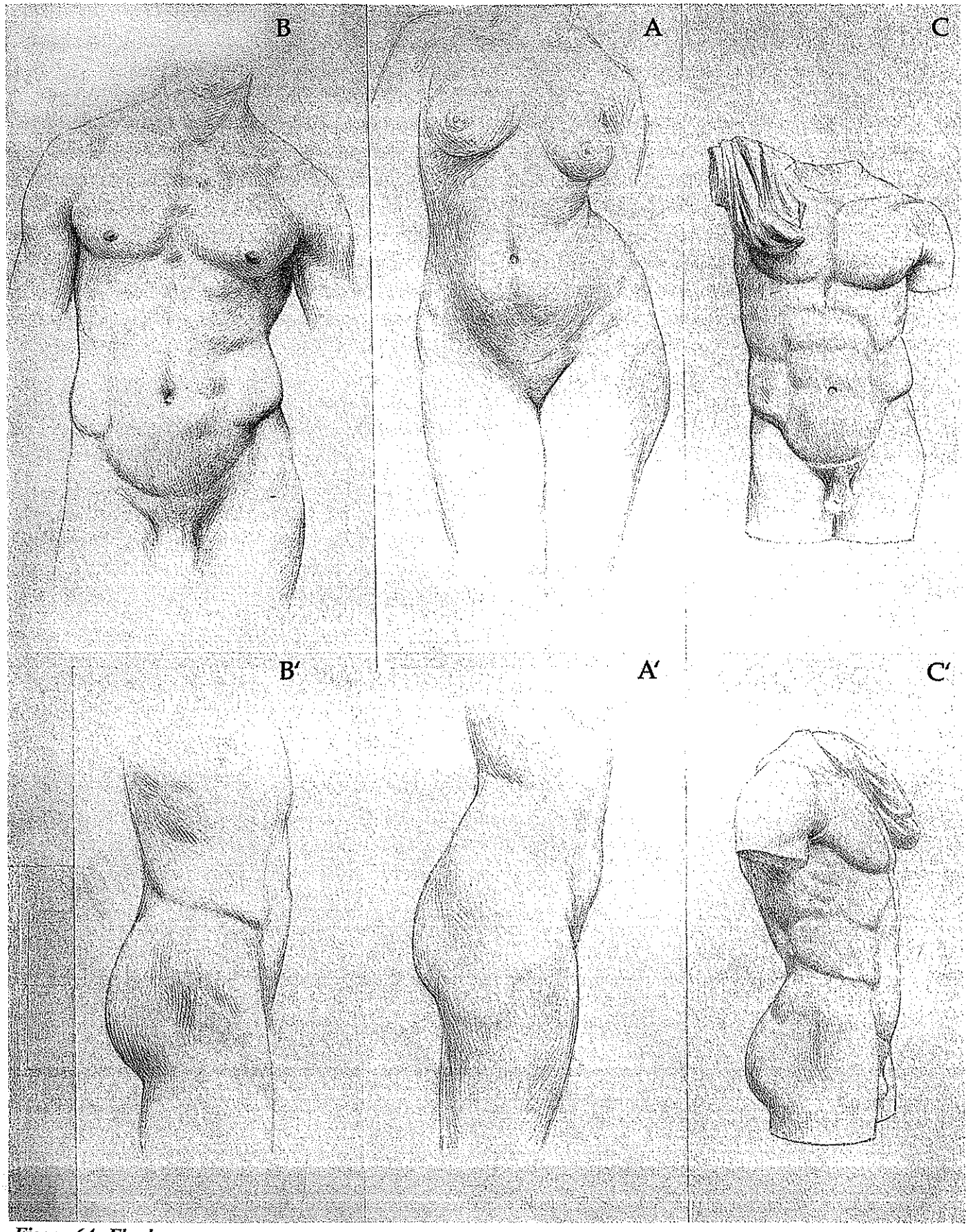

Figure 64: Flank

Figure 64 (left): Flank

A, A' Feminine type: front and profile
B, B' Masculine type: front and profile
C, C' Antique type: front and profile

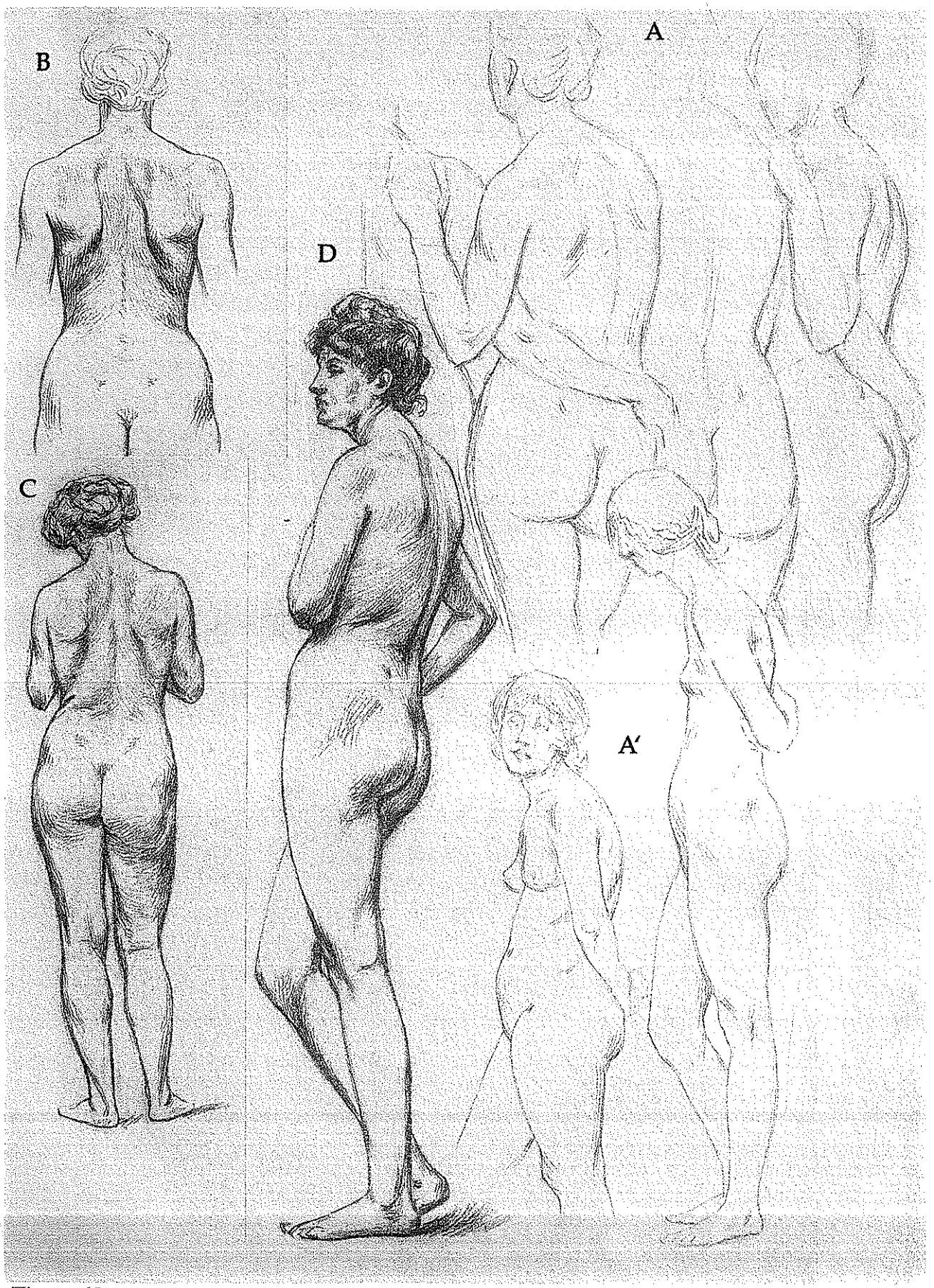

Figure 65: Several examples of hollow backs and round backs

7. Back

There is no need to subdivide the feminine back as we have for the masculine because the regions thus delineated: the spinal region in the center, and the scapular and subscapular regions on the sides, are distinguished mainly on muscular models. Certain images of women from the Renaissance, when many artists had made anatomical exaggeration fashionable, lend themselves well to this type of division. But in nature, the feminine back is much more simple and translates itself by its large planes.

A vertical furrow, commonly called the *line of the back,* runs along the median line through the entire height of the back. It extends past the loins to disappear in the sacral region. This furrow, which corresponds to the projection of the spinous processes on the skeleton, becomes deeper as the muscles that surround it become more developed. From the top, it begins below the flat oval plane of the cervical dorsal aponeurosis, or the projection of the fat deposit that sometimes conceals the aponeurosis. The bottom of the furrow is generally a unified surface and does not allow the projections of the spinous processes of the vertebrae to appear, except on very thin subjects or in the forward flexion of the torso. The furrow follows the convex direction of the curvature of the spinal column. This curve is sometimes exaggerated in young girls who are weak, accompanied by falling shoulders and a forward projection of the abdomen (Figure 65, A'). This unhealthy conformation seems to have inspired masters of the Renaissance and we find this form in a great number of figures from that era. A moderate curve of the spinal column combined with good development of the neighboring muscles creates a full back, of which the antique Venus offers us numerous examples. Finally, an exaggerated straightening of the spinal column accompanied by a weak volume of muscle makes the back hollow (Figure 65, B), a conformation that is not rare to encounter in models today, and is often accompanied by thin shoulders, placed high: *épaules en porte-manteau.*[41]

The sides of the back are occupied by the scapulae, which are surrounded by muscles that are well known. The medial edges of the scapulae are oriented vertically and separated from each other by about two hand-widths. These edges of the scapulae are not visible under the skin unless the subject displays the muscular weakness that accompanies the hollow back; they disappear in muscular models with a full back. On backs that have a good development of muscle without too much fat, the shapes described in the man can easily be identified in the woman. It is always good to have these forms in mind in order to understand the shape of a feminine back with its lesser degree of muscular development, and especially, to understand the movements of the shoulders and the arms. I will only add that it is not rare to see a long oblique fold, or a simple linear depression, run through the back, descending from the median superior part of the back in an almost imperceptible manner, then becoming accentuated below the lower corner of the scapula, to finish at the posterior end of the superior crease of the flank. This form follows the lower edge of the rhomboid and below this, the radiating projection of the serratus anterior.

Figure 65 (left): Several examples of hollow backs and round backs

A, A'. Sketches of round backs

B, C. Hollow backs

D. Curving of the spinal column with the characteristics of the hollow back caused by weakness of the interscapular muscles.

[41] 'coat-hanger shoulders'

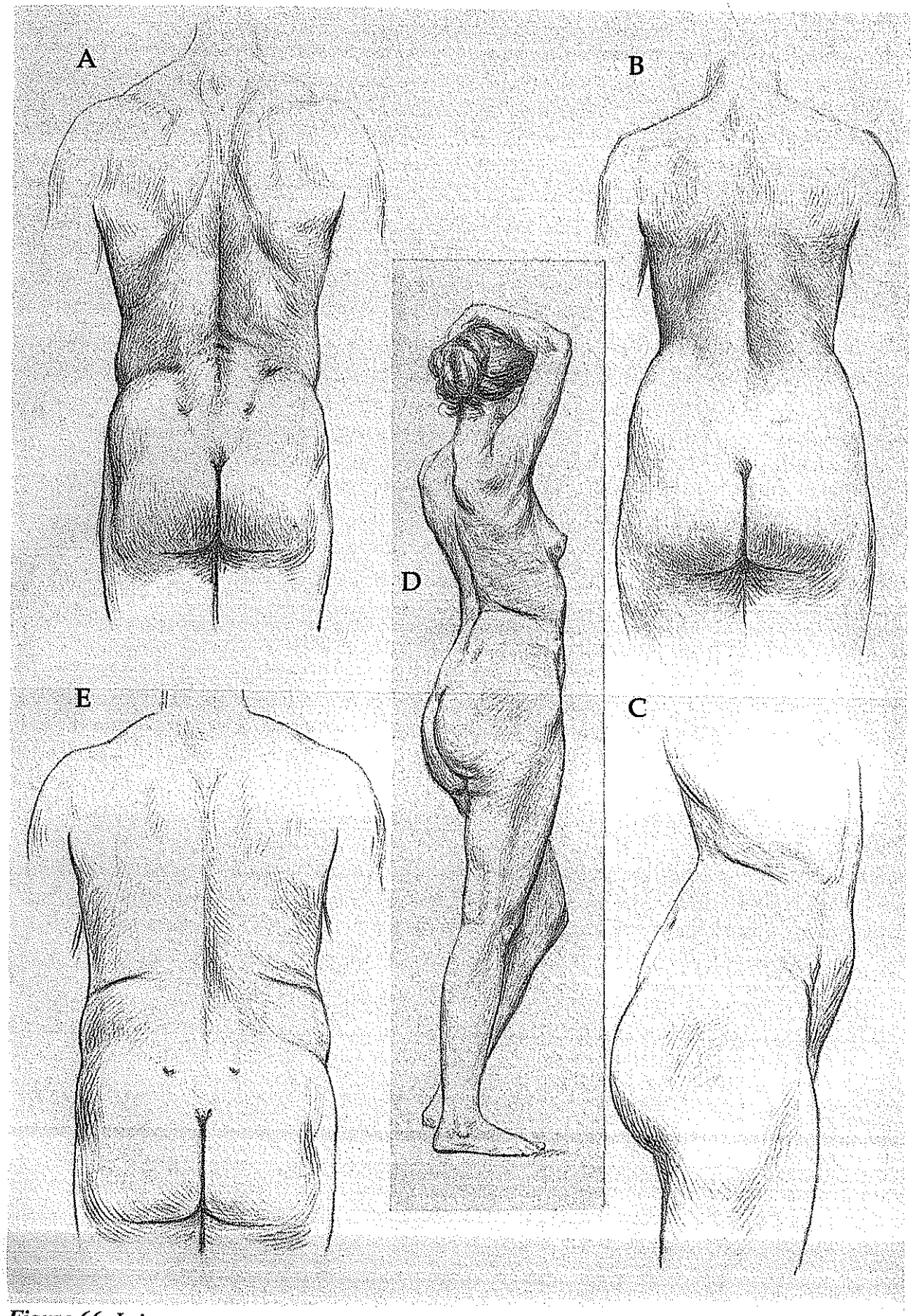

Figure 66: Loins

8. Loins

The loins are an intermediate region between the thorax and the pelvis.

On each side of the median furrow, the lower back is lined by the powerful masses of the spinal muscles that extend through the loins until the posterior surface of the sacrum. By their volume, these masses exaggerate the depth of the central lumbar furrow along the line of the back. Wide and deep, this furrow corresponds to the spinous processes of the lumbar vertebrae on the skeleton, which, on men, reveal themselves from the surface as a series of nodular projections submerged in the bottom of the furrow. In women, these bony forms are typically hidden in upright posture and only reveal themselves in movements involving flexion of the torso.

The median lumbar furrow descends until the sacrum, where it terminates around the middle of the sacral surface in the *median lumbar fossa.*

Two other fossae are important to indicate on the boundary of this region; these are the *lateral lumbar fossae*, which are important to understand because they are the cause of forms that change with gender. In men, two pairs of these lateral lumbar fossae appear: superior and inferior (Figures 68 and 69). The superior one is situated at the upper corner of the iliac crest, at the posterior end of the iliac line. The inferior one is situated a bit lower and inside, and corresponds to the iliac tuberosity. In women, the superior lateral lumbar fossa does not exist; it is filled, as I have said before, by the fat pad of the flank. Only the inferior lateral lumbar fossa persists and, by its isolation and its constancy, takes on a very special importance in the morphology of the region (Figure 66, B).

In overweight men, the fat pad of the flank grows so that it completely masks the superior lateral lumbar fossa, leaving only the inferior one, as we see in women. On the other hand, on rare occasions one can identify the superior fossa in a woman, though it may be very subtle. I have seen a young girl in whom the shape of the whole region presented the closest analogy with the antique statue of the Hermaphrodite in the Berlin Museum (Figure 67). The masculine form, when it evolves towards the feminine, arrives at the same result illustrated in Figure 67, D, made from a sickly young boy at the Salpêtrière who presented all the signs of femininity.

Two lines extend from the inferior lateral lumbar fossa to join at the summit of the gluteal cleft, describing an angle that opens upwards (Figure 68). In men, this angle is always acute, while in women it approaches a right angle, which it may sometimes exceed. For women, this angle averages 78°17, with a maximum of 92° and a minimum of 61.° For men, its average is 62.7.°

Figure 66 (left): Loins

A. Masculine type with two lateral lumbar fossa: superior and inferior

B. Feminine type with only the inferior fossa

C, D. Adipose pad from the profile and ¾ view

E. Loins in an overweight man with the disappearance of the superior fossa following the development of the fat pad of the flank.

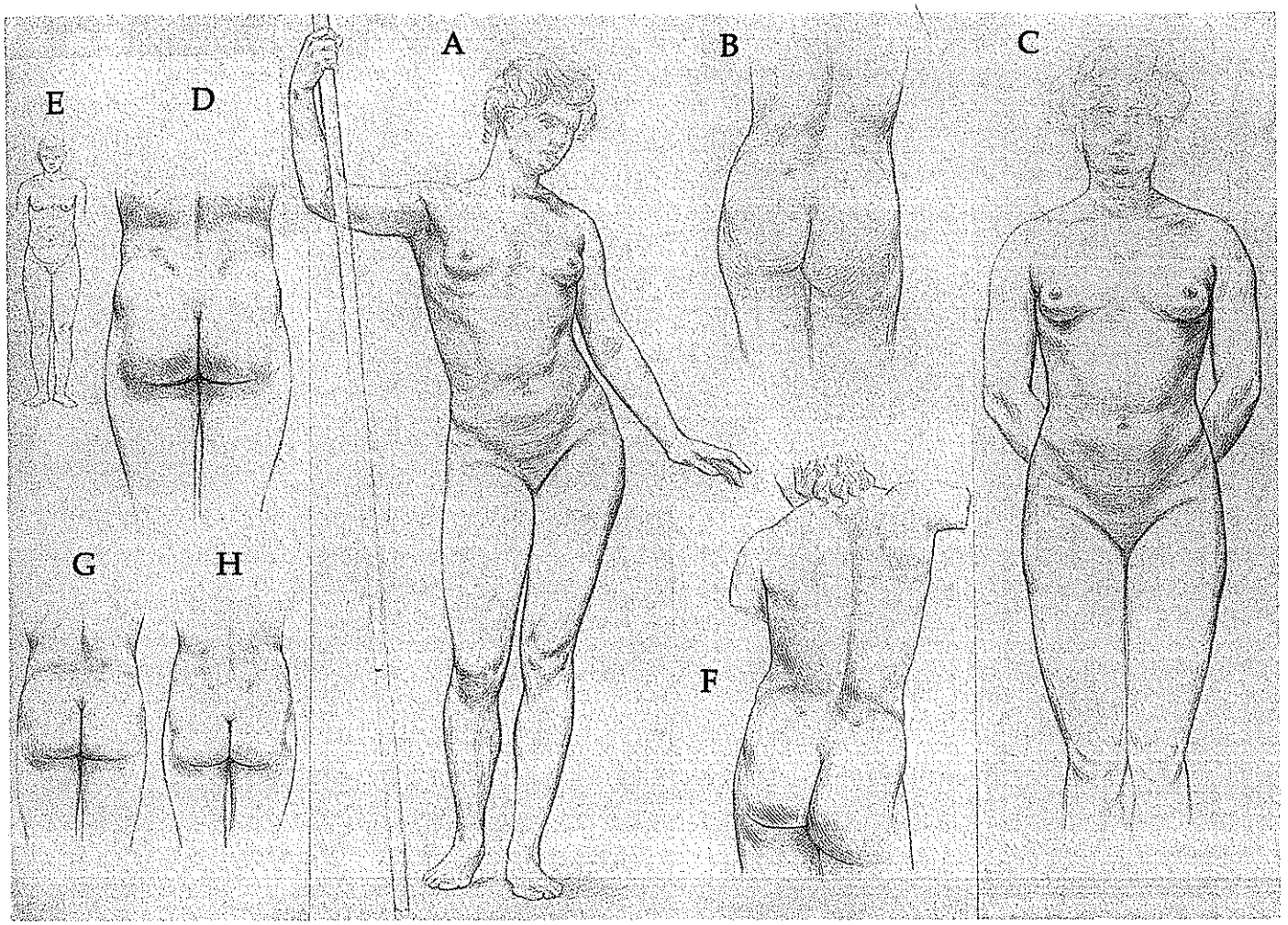

Figure 67: Morphological variations in the loins

A, B, C. Intermediate type between masculine and feminine forms in a young girl who presented some of the characteristics of the antique hermaphrodite; in the loins, B, the superior lateral lumbar fossa persists subtly.

D. Loins in a masculine subject presenting characteristics of the antique hermaphrodite

E. Sketch of the same subject, from the front

F. Loins from the antique sculpture of Hermaphrodite at the Altes Museum in Berlin

G, H. Two examples in men of the near complete disappearance of superior lateral lumbar fossa

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In women, one observes a fatty pad at the loins (Figure 66: C, D). It is not constant. Only its lower half is well defined, which corresponds to the sacral region within the opening of the sacral angle, which I just mentioned. Its upper half, with more indistinct limits, is less tall and its edges embrace the inferior limits of the spinal muscles. Its entire surface makes a moderate projection, caused by a fat deposit that Charpy placed under the lumbar aponeurosis. In those with moderate fat development, its shapes disappear into the surrounding fat. One only observes them, therefore, when a woman does not present fat deposits that are too abundant. It does not exist in men.

The *height of the loins*, measured along the lumbar spine in an absolute fashion, is not greater in women than in men. It may even be less according to Charpy, who gives the following measurements:

Men = 13.6cm Women = 11.6 cm

Relative to their height, there would be equality between the two sexes.

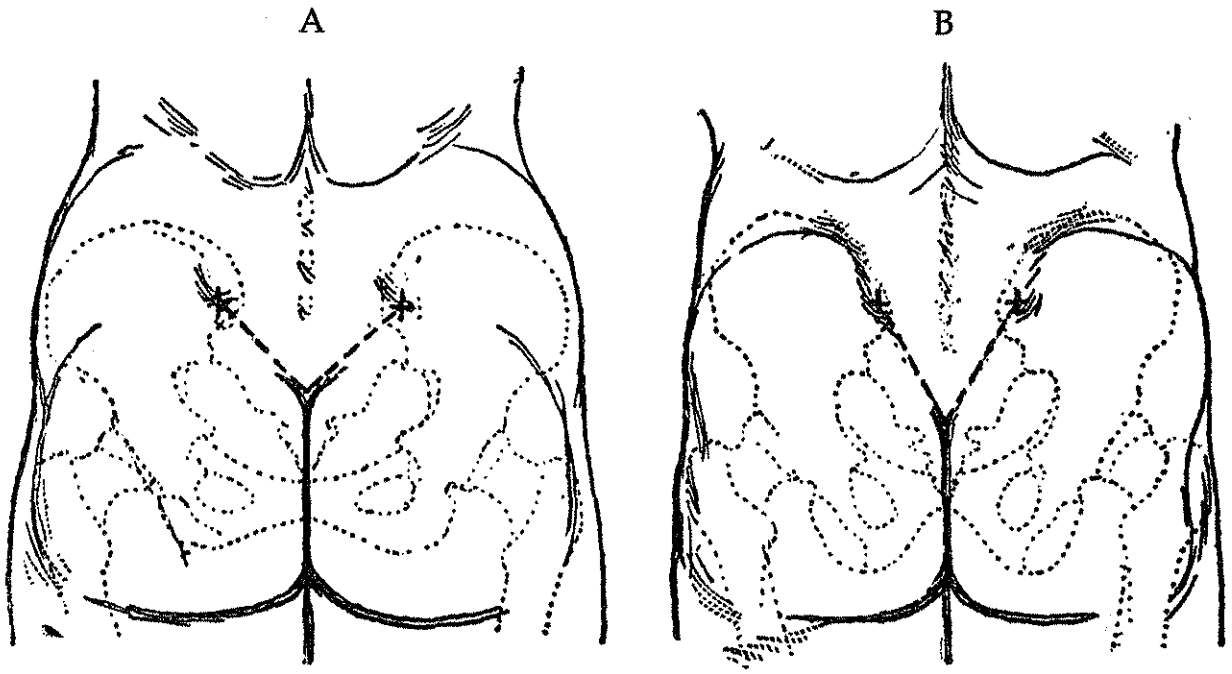

Figure 68: Lateral lumbar fossa in a woman (A), and a man (B)
The sacral triangle is a right angle in women and acute in men.

By the length of her torso, the lesser height of her pelvis, the narrowing of her lower ribcage, and by the greater distance between the two iliac crests and the ovoid shape of her lower ribcage, the woman has the appearance of a longer region of the loins, whose suppleness and flexibility are commonly observed.

The *width of the loins* is determined from the bi-iliac posterior diameter, whose greater dimension in women is universally recognized. Charpy found this result, taken from 71 subjects:

Men = 94 mm Women = 97 mm

My measurements reveal a greater difference here. For the bi-iliac posterior diameter, I found:

Men = 88 mm Women = 103 mm

This diameter is larger in women because of the greater width of the sacrum, whose base makes a part of the superior strait of the pelvis.

In determining the height of the loins, it is necessary to take the variations in position of the sacrum into account. It may be deeply implanted between the coxal bones or it may lie closer to the posterior surface of the body, as I mentioned earlier.

The loins constitute the region of passage between the back and the buttocks; they are like a bridge built between the thorax and the pelvis. Susceptible to great variations, this is, of all the regions of the body, one whose fundamental shapes are most often masked or altered by secondary, inconsistent details. Thus, the oblique folds caused by relaxation of the lumbar muscles, which vary with individuals and with the physical state of the muscles

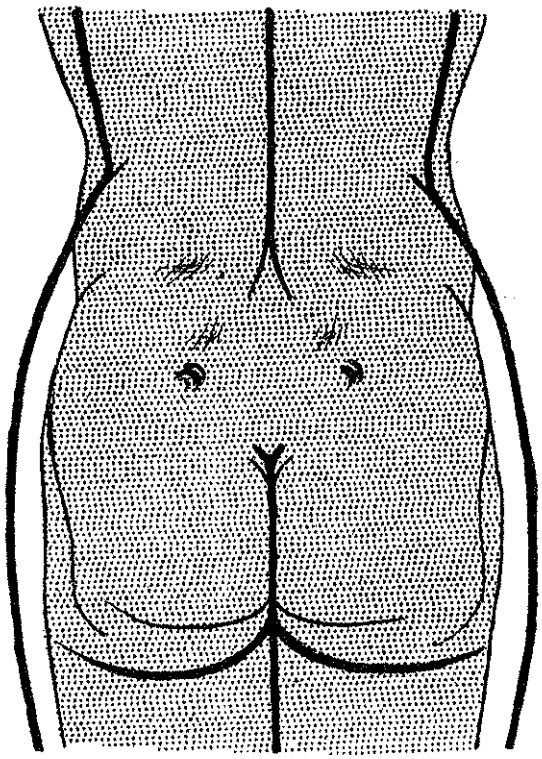

Figure 69: Schematic diagram of the superposition of the loins of a man and a woman. *The masculine silhouette has been shaded grey; the feminine is marked in bold lines.*

that control the posture, very often disturb the unity of the region. In addition, the exaggeration of the lumbar arch, caused by a greater tilt of the pelvis, has the effect of creating a large transversal depression in the middle of the loins. This depression divides the loins, so to speak, into two parts, thus destroying its effect of uniting the two great regions of the body that border it from above and below. These secondary forms, which are harmful to the figure's sense of harmony, disappear with a slight forward flexion of the torso. It is interesting to note that people in Antiquity had this preference, taking a pose that is slightly hunched forward for all their Venus figures.

Variations often occur in the areas neighboring the posterior part of the flanks, according to gender and among individuals, which adds again to the complexity of the region. The rule of the single lateral lumbar fossa on women and double on men certainly has many exceptions, as is clear from what was mentioned above. But I must excuse myself if, at the risk of repeating myself in trying to be precise, I return to this interesting question of common morphology between men and women.

Of the two lateral lumbar fossae, the inferior, which corresponds to the bony projection of the iliac tuberosity, is undoubtedly the more fixed, the most clearly defined, and the most constant. The superior fossa, corresponding to the bony depression that constitutes the corner of the ilium, is less precise, less isolated, and more susceptible to alterations that can lead to its suppression. The superior lumbar fossa is the end point of the iliac line in back and of the coxo-sacral crease above. The accumulation of fat under the skin most often accentuates the inferior fossa, while it causes the superior fossa to disappear.

I have said that the absence of the superior lumbar fossa in women is due to the abundance of the panniculus adiposus on top of the flank. However, it is not uncommon to see it persist to a variable degree on young subjects with no excess weight, replaced by a depression that may be wide or narrow, leading to a largely open iliac line that, in this case, always persists to some degree. On the other hand, in men, it disappears entirely on an overweight subject, and on young men with effeminate shapes, it is replaced by a depression reproducing the shape that I have described for certain feminine subjects. It is such that, in both sexes, on one side by a dearth, on the other by a surplus, we find one of these intermediate forms realized, which the antiques, quite appropriately, gave to their figures of hermaphrodites (Figure 67).

The pelvic bones relate to several exterior regions: the *pubis*, *groin*, *hips*, and *buttocks*.

9. Pubis

The pubis rests on the bone of the same name. The skin here is lined with a fatty tissue that softens the bony forms. It is shaded with hair. The pubis projects more on the female, and is called the mount of Venus. Its upper

border consists of a transversal fold that may rejoin the crease of the groin. Together, these skin folds indicate the anterior opening of the pelvis. The pubis is triangular in shape and bordered on the sides by the creases of the thighs as they rise towards the groin.

In young subjects, the suprapubic crease is shorter. It does not rejoin the groin in an oblique shape, and is only seen in the middle region, taking a slightly curved shape with an upward concavity.

At other times, however, the suprapubic crease exceeds the region and cuts the crease of the groin obliquely, extending itself to become a secondary fold of the groin.

10. Groin

The crease of the groin separates the thigh from the abdomen. It descends diagonally from the extremity of the flank to the pubis, and follows the direction of the inguinal ligament which maintains the form of the groin.

In standing posture, the crease of the groin appears as a wide, shallow fold. It diminishes during backward bending, or extension of the torso, and it takes, to the contrary, a slight degree of lateral inclination. In the flexion of the thigh to the torso, it takes the shape of a deep crease that is not dissimilar to the fold of the armpit when the arm falls alongside the body.

At its outer extremity, the crease of the groin continues into the iliac line, with which it makes a rather obtuse angle, always passing inside the iliac spine. At its medial side, it rejoins the suprapubic crease or even descends below the pubis to continue into the crease of the thigh. These two different termination points correspond to two variations in the shape and direction of this crease (Figure 70).

When it approaches the horizontal (Figure 70: B, D), the crease of the groin is uniformly curved and continues directly with the suprapubic crease. In this case, the crease of the groin on both sides joins the suprapubic crease to make a long belt that marks the lower limit of the abdomen and which Antique artists have so strongly accentuated. This form accompanies the spreading of the iliac bones that characterizes the open pelvis, and the whole region diminishes in height.

When it is more oblique (Figure 70: A, C), the crease of the groin follows a slightly undulating trajectory with superior concavity turned towards the abdomen; other times it is rectilinear and ends at the fold of the thigh below. In this case, the two folds of the groin describe an angle that is more or less acute, whose truncated summit is occupied by the genitals. This form corresponds to the upright alignment of the iliac bones, which is characteristic of the closed pelvis, and thus the whole region is augmented in height.

Below the crease of the groin is the fold or crease of the thigh. It is always very visible on women, and very accentuated on fatter people. This crease begins between the pubis and the inside of the thigh and runs anteriorly around the root of the limb following a slightly ascending direction. It finishes a few fingers' width below the anterior superior iliac spine in a depression that corresponds to the spacing of the tendons of the two muscles that insert there: the sartorious and the tensor fascia lata; this is the femoral triangle. The crease of the thigh makes an acute angle with the crease of the groin, opening towards the outside. This angle varies in size between the two types of pelvis; it is more closed, or more horizontal, in the open pelvis, and more open, or sharper, in the closed pelvis.

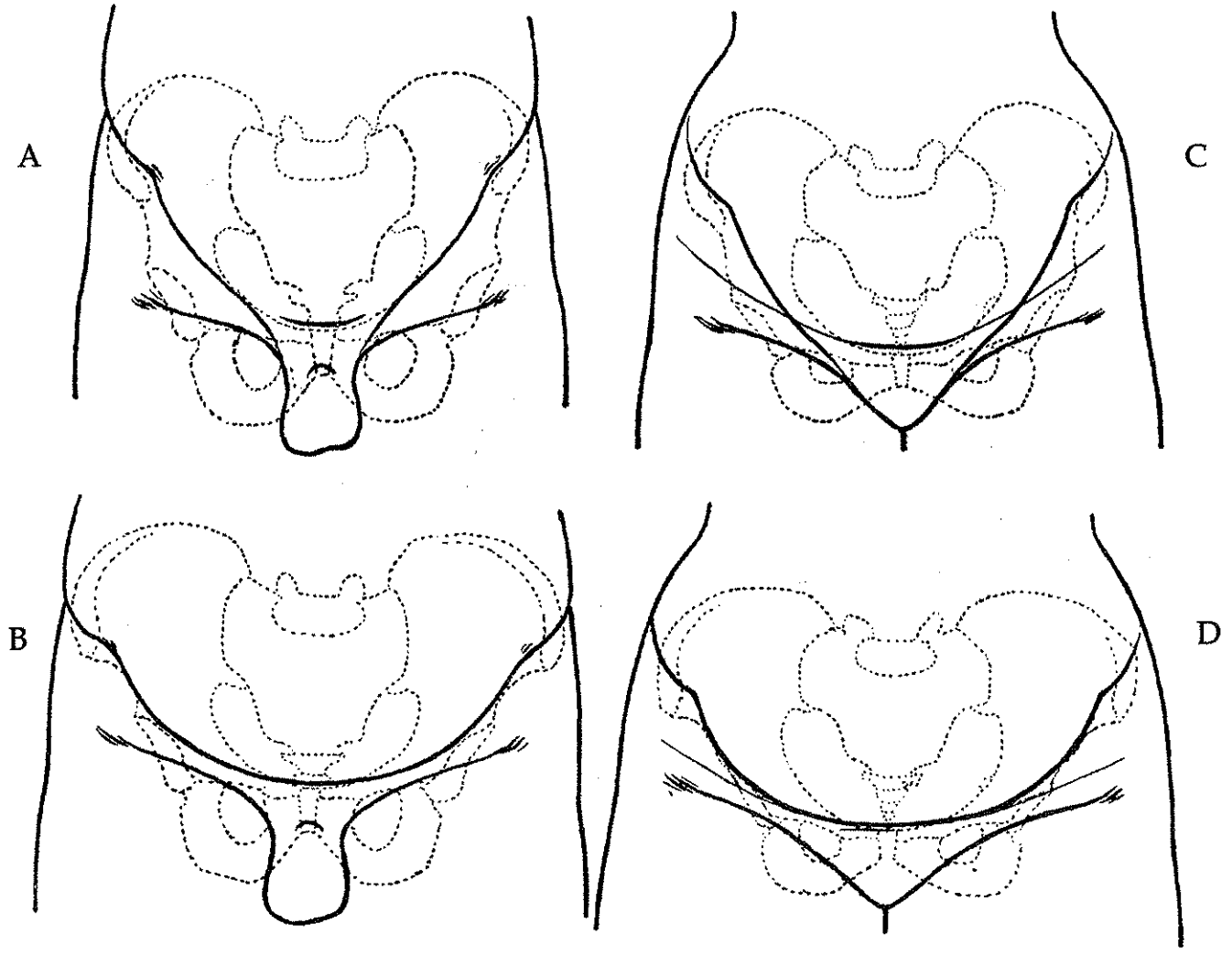

Figure 70: Diagrams of the shape of the crease of the groin in a closed and an open pelvis, in men and women.

A, C. Closed pelvis: creases of the groin are oblique, curved, and descend to the crease of the thigh. The inguinal angle is open, giving height to the region of the groin.

B, D. Open pelvis: creases of the groin are less oblique and run into the the suprapubic crease. The inguinal angle is more closed, making the groin short.

The same is true of the angle formed by the crease of the groin and a horizontal line placed at the top of the pubis. The distance between the iliac spine and the extension of this horizontal gives the height of the region, which is variable according to the closed or open conformation of the iliac crests. The distance is greater for a closed pelvis and less for an open one.

Charpy gave the following description of these two forms: In the closed pelvis, "the hips are squeezed; the creases of the groin, almost rectilinear, descend with a strong tilt towards the thigh and generally continue into the crease of the thigh. The angle of this tilt is from 55° to 60.° It opens to the outside, with its lower side made by a horizontal line placed at the inside of the inguinal fold, and its summit around the symphysis pubis. Between the two creases, separated by an angle of convergence from 60° to 70,° the compressed abdomen elongates itself into a point as it continues with the genitals."

"In the wide or flared form (open pelvis), the hips are spread out and project. The creases of the groin are slightly tilted from the horizontal at 45° or 50,° making an angle of convergence of 80° or 90° between them, nearly a right angle; they continue with the suprapubic crease."

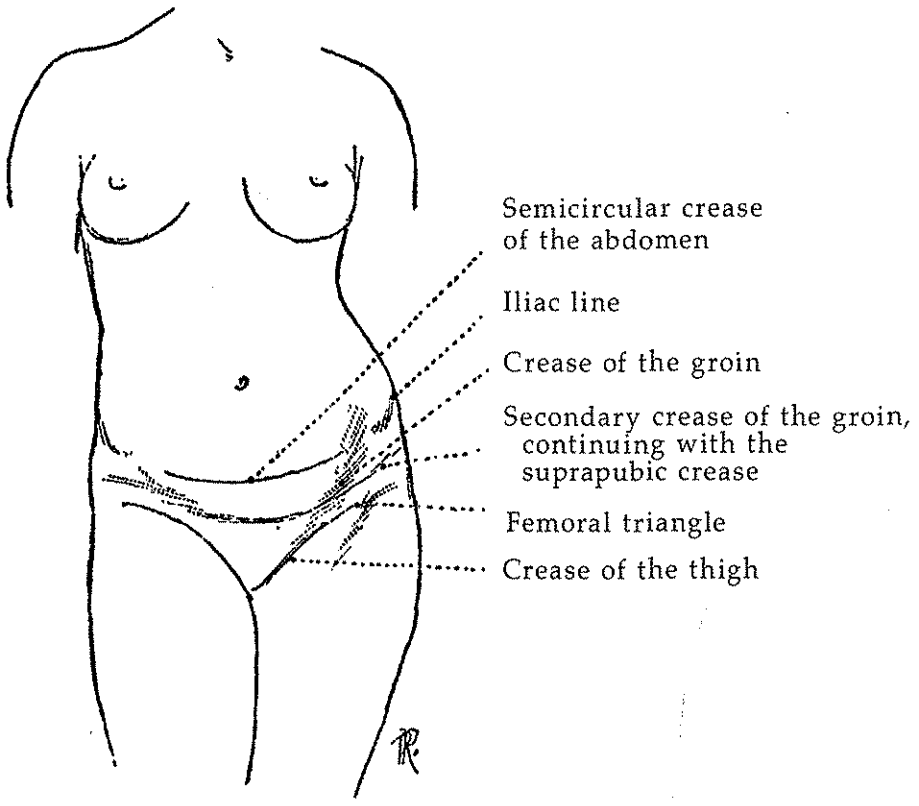

Figure 71: Region of the groin in women

What jumps out most, regarding the morphology of the groin in relation to the two types of pelvis, is the different development of the region that could be measured by the distance between the iliac spine and the femoral triangle below it, where the crease of the thigh ends (Figures 72, 74). In the closed pelvis, this distance is rather considerable, and it diminishes in proportion to the degree of opening of the pelvis. And this feature, in short, is more important than the shape and direction of the crease of the groin on which, apart from the bony conformation, the degree of weight carried by the subject also has a marked effect. When the abdomen is filled with fat, it weighs, so to speak, on the creases of the groin, which become curved and rejoin above the pubis, describing an inverted semicircle that completes the abdomen from below.

It is in this sense that Charpy could state that the closed pelvis is characteristic of adolescence, while the open pelvis appears more often in mature age. In women, one observes these two forms very clearly. Also, one must not forget that between these two extreme forms are all degrees of intermediate ones, which are certainly those that one encounters most often.

In all cases, whatever the inclination of the fold of the groin and the distance that separates the iliac spine from the femoral triangle, this distance is often divided into two equal halves by a secondary transversal fold that cuts the fold of the groin diagonally to continue with the horizontal crease at the upper limit of the pubis (Figure 71).

11. Hip

This term defines the region that projects from beneath the flanks on both sides, from the iliac crest to the great trochanter, between the buttock in back and the crease of the groin in front. The length of the proximal end of the femur, as well as the inclination of its neck, influence the width of the hips. In addition to the average inclination of the neck of the femur, there is, for men as well as women, a type with a greater angle and a type with a smaller one. The larger angle corresponds to the more slender forms, the smaller angle to shorter and wider forms.

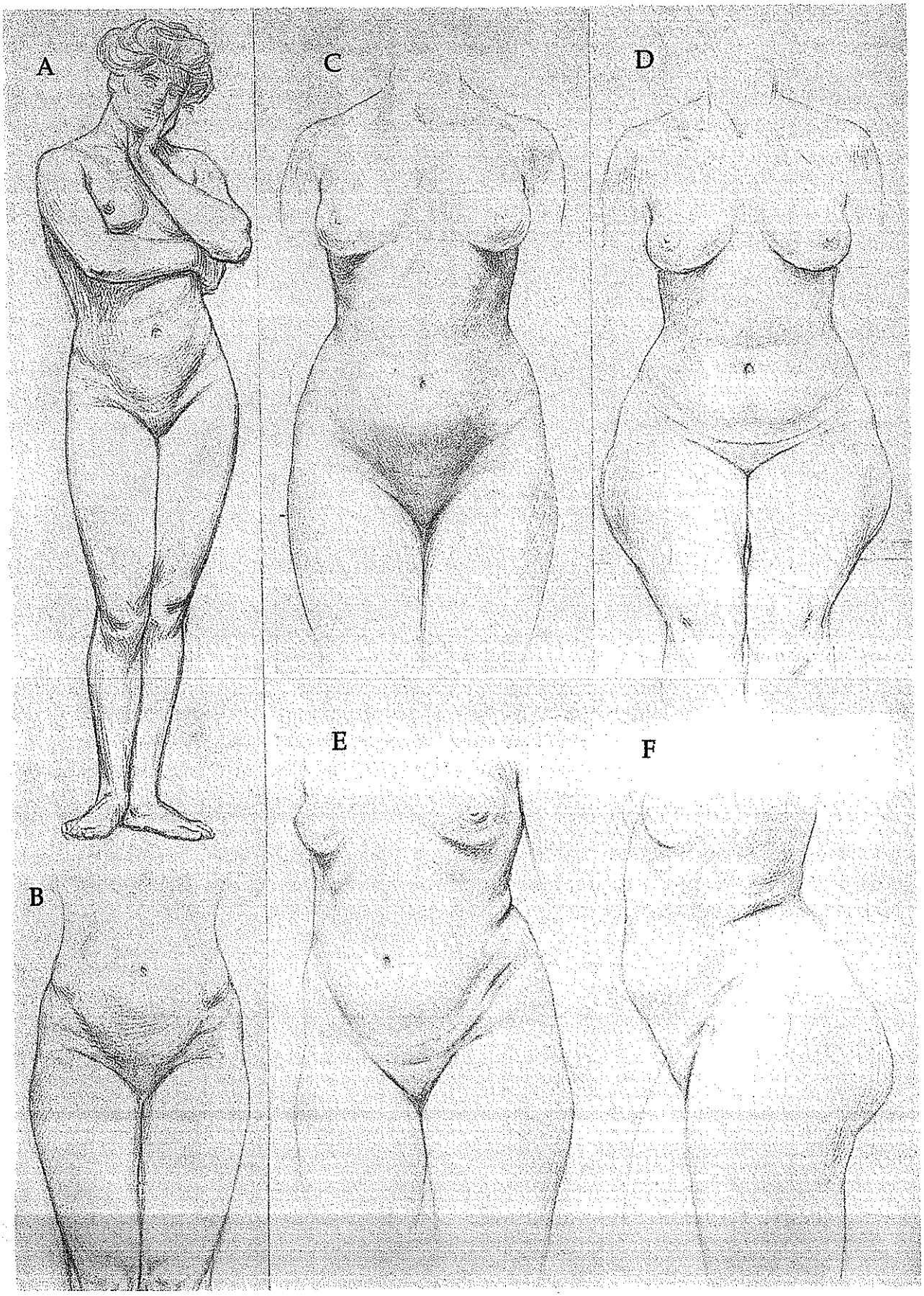

Figure 72: Several examples of a closed pelvis with characteristic shapes of the crease of the groin.

This region is completely occupied by the gluteus medius (Figure 73) which gives it a convex form in all directions, but predominantly in the transverse direction. This muscle is held in place by a strong aponeurosis that descends from the iliac crest and forms a part of the fascia lata.

The relief of the hip is augmented by a panniculus adiposus that, most often, merges with that of the neighboring regions. But, in certain subjects, this fat deposit is particularly developed and gives a certain independence to the morphology of this region, demonstrated by the illustrations in Figure 76.

The greatest width of the hips exists at the great trochanter, which always passes just outside of the iliac crest. The hip does not have precise limits in front and in back, while at the top it is clearly bordered by the iliac line, and at the bottom, by a very superficial transverse depression that separates it from the lateral plane of the thigh.

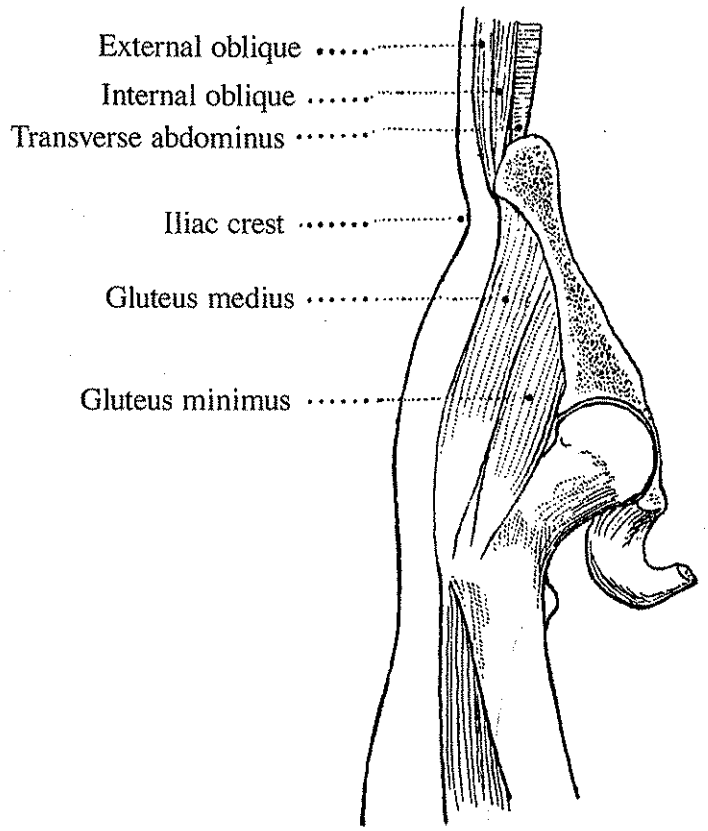

Figure 73: Transversal vertical section of a woman's hip
Compare with Figure 63, page 130.

According to other authors, the width of the hips as represented by the bi-trochanteral diameter is approximately the same in the two sexes; it was found to be 32 cm in absolute measurements. According to my measurements, if the average bi-trochanteral dimater in the man is indeed 32 cm, then that of the woman will be significantly greater. I found an average of 33.31 cm for women. In men, I observed a maximum diameter of 36 cm. and a minimum of 29.2 cm, and in women, a maximum of 36.5 cm and a minimum of 29 cm. The measurement of the circumference of the hips confirms the results from the measurements of the bi-trochanteral diameter: it is 91.4 cm in men and 93.13 cm in women.

Figure 72 (left): Several examples of a closed pelvis with characteristic shapes of the crease of the groin

A, B. In young subjects with slight development of their fat deposits, the oblique direction of the crease of the groin continues into the crease of the thigh. The secondary crease is also quite evident. In A, the relatively narrow pelvis clearly shows the morphological qualities of the closed pelvis: iliac spines close to the median line, crease of the groin is oblique and curved, height in the region of the groin. In B, the pelvis is more developed yet the forms are similar.

C. The subject has more body weight, yet the same forms can easily be seen.

D. The same model seen in C, in seated posture. The secondary crease is accentuated.

E, F. Sketches from a model with a remarkably small anterior iliac diameter, which seem to make the anterior region of the flank sink in, while the abdomen projects forward.

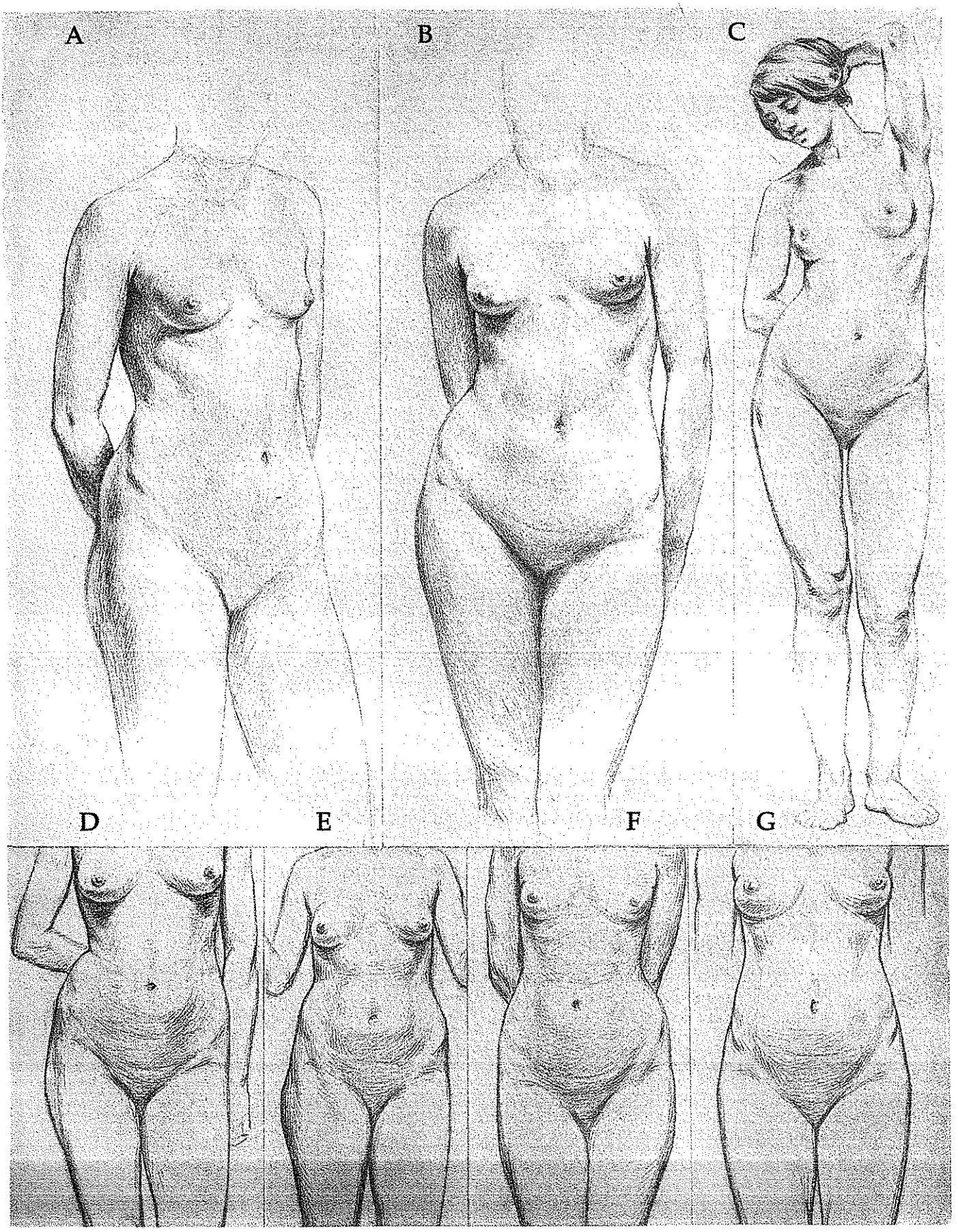

Figure 74: Several examples of the open pelvis

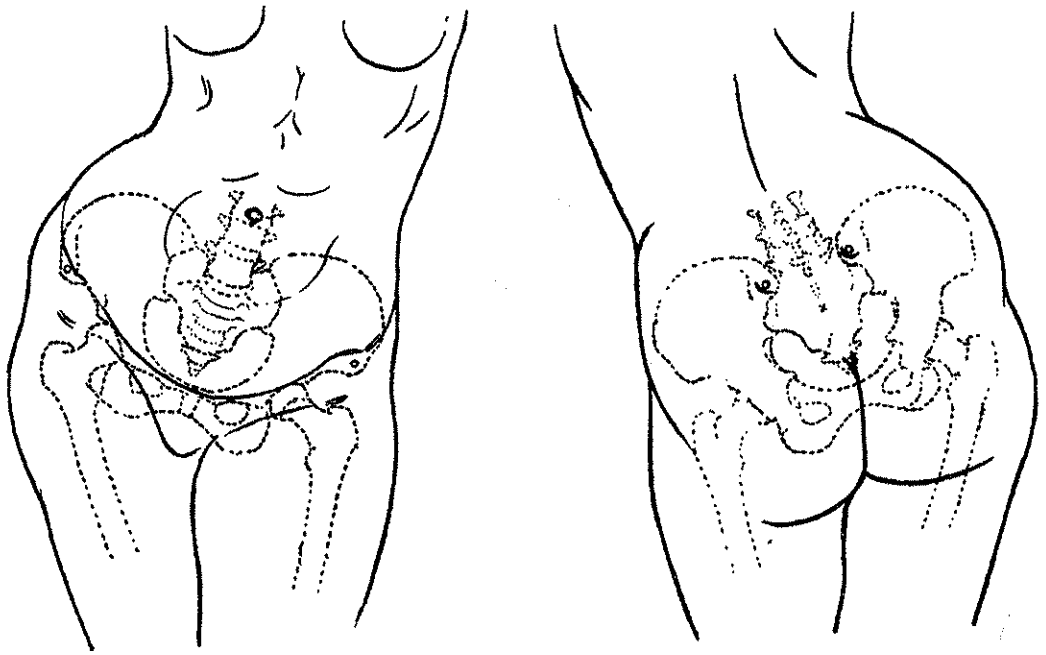

Figure 75: Hipped posture. *This pose has the effect of projecting the hip on the side of the standing leg, sometimes to the point of exaggeration. It is an element of contraposto.*

Therefore, the predominance of the hips remains one of the genuine attributes of the feminine sex. Within this predominance, Charpy ingeniously found the coexistence of three types: a petite size, a general conformation, and a size with more adipose development. His interpretation is interesting because he derived these three types from direct measurements.

Certain authors place the maximum diameter of the woman's hip a bit below the great trochanter. This assertion is only true if one includes the subtrochanteric fat deposit, which, when it exists, generally projects more than the bony relief.

In the form of the woman's hip, the widening of the iliac crests has the effect of diminishing the depth of the iliac line to the point that it sometimes seems to disappear, although a strong light will always reveal its existence. Whatever it may be, the consistent diminution of the iliac line simplifies this large region, which extends from the great trochanter to the crease of the waist, and to which the bony relief, while hidden, gives its solidity and its power.

On the sides of the pelvis, the hip is bordered by two other forms: the flank above and the subtrochanteric fat deposit below. Now, sometimes it happens that the three projections thus arranged from top to bottom are very distinct from one another. At other times, they are more or less combined and lack precise limits.

Figure 74 (left): Several examples of the open pelvis

A, B. A type of very open pelvis in a young girl, showing the brevity of the region of the groin, and all the other signs of an open pelvis: iliac spines set wide apart, crease of the groin approaching the horizontal to continue into the suprapubic crease below.

C, D, E, F, G. Sketches showing the same traits in different subjects, each with individual variations.

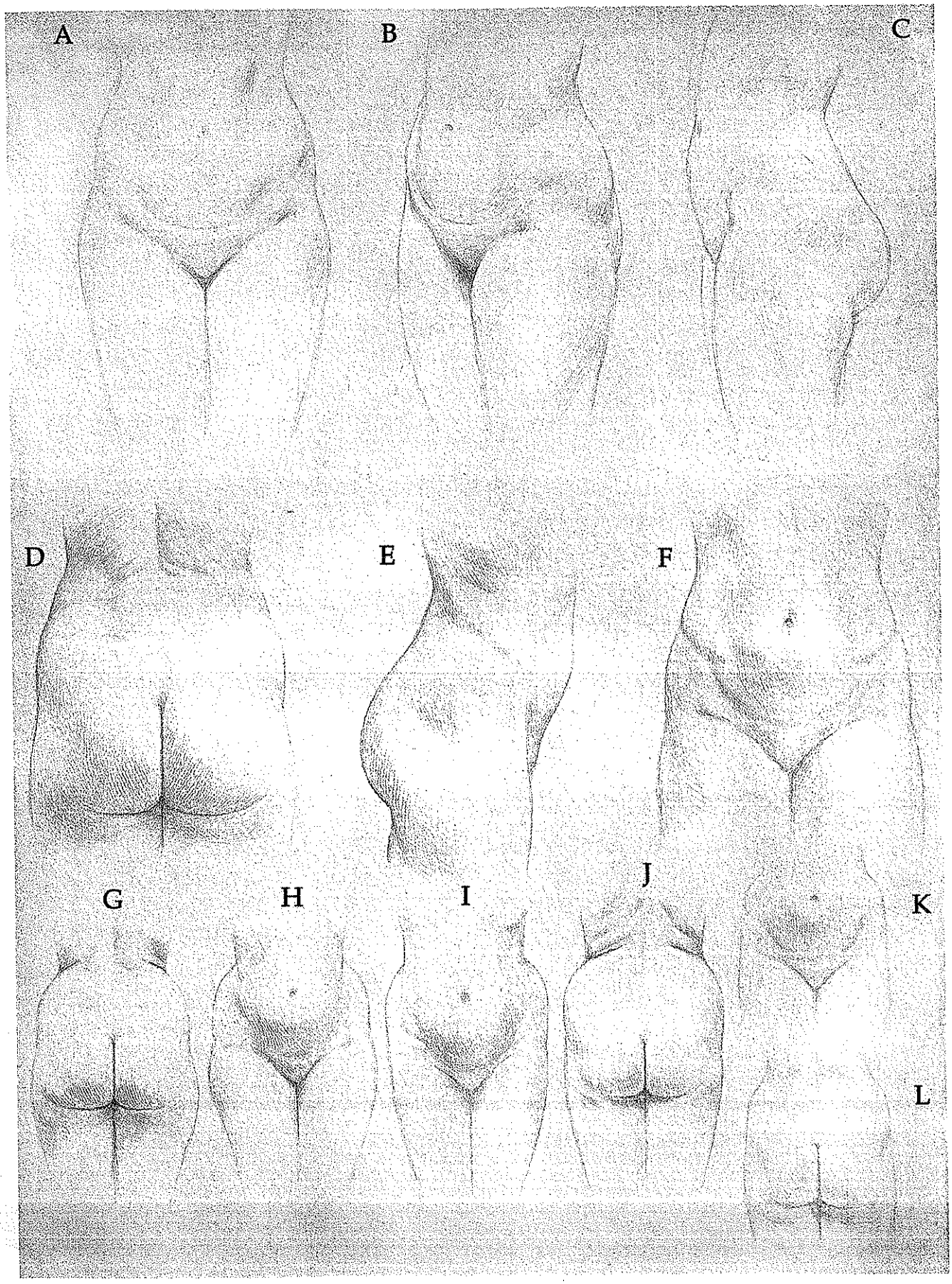

Figure 76: Several examples of a prominent fat deposit of the hip

If the woman's flank remains clearly defined from above, it usually loses the precision of its lower limit, which creates the form of the iliac line here in the man. This line is, in fact, only visible in front, merging on the outside with the hip and in the back with the buttock; but it can be otherwise. In some beautiful models, it is not rare to see the iliac line widened, persisting as a shallow furrow, with the flank offering an ordinary projection above and the hip normally developed below. Other times, the flank is considerably reduced in its relief and its height, and finds itself absorbed, so to speak, by a voluminous hip. The hip begins thus at the crease of the waist; this is seen especially in heavier subjects. But this conformation is also found in young subjects with modest fat development, and is distinguished by very diminished flanks, which make the waist short. Regarding the projection below the hip, it is usually rather distinct from the hip itself and occupies the superior and outer part of the thigh.

One will understand the variations in the contours of the pelvis, seen from the front, according the degree of development of these various parts. The contour of a single curve due to their amalgamation could be replaced by a curve with three inflections, unequal in length and accentuation, due to their relative independence. What's more, the general direction of this curve varies, presenting its greatest convexity either above or below, depending if it is the flank and the hip together, or the fat deposit at the root of the lower limb that predominates (Figure 76).

12. Buttock

In back of the pelvis, the buttock is preeminent. It corresponds to the muscle of gluteus maximus, which is sometimes separated from the region of gluteus medius by a shallow oblique crease.

The fat that always lines the skin in this area plays an important morphological role. It acquires its maximum thickness at the inferior and medial part, and the projection of the whole area is due more to the accumulation of fat than the development of muscle. This area is most characteristic in women, whose muscular system is generally less developed, yet whose form is distinguished nevertheless by the projection of the buttocks. I have already mentioned that the steatopygia of the women of the San and Khoikhoi peoples is due to an exaggerated development of the panniculus adiopsus,

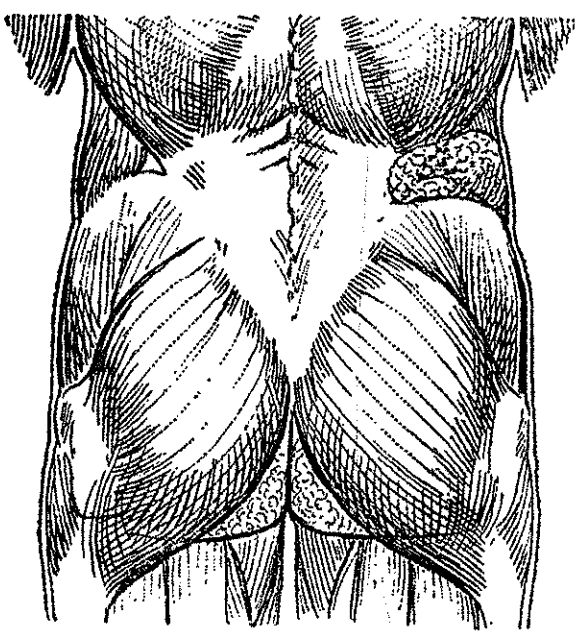

Figure 77: Anatomy of the buttock. *Discrepancy between the gluteal fold and the lower edge of the gluteus maximus.*

Figure 76 (left): Several examples of a prominent fat deposit of the hip

A, B, C. Subject, 20 years of age, clearly showing the fat deposit of the hip.

D, E, F. Another subject, 30 years of age, in whom the flank is clearly separated from the thigh by an iliac line that is rarely so prominent in women.

G, H. Here, the fat deposit of the flank is not separated from that of the hip, so the two regions merge together. The subtrochanteric fat deposit is clearly shown.

I, J. Similar disposition to G and H but with the absence of a subtrochanteric fat deposit.

K, L. Hip and flank are completely merged together in a young subject with a slight build.

and it is not without interest to note that, in Europeans, the relief of the buttocks is highly variable and offers, so to speak, all degrees of moderation of this curious anatomical disposition.

On the lateral side, the projection of the buttocks is separated from that of the great trochanter by a wide depression caused by an aponeurosis for the insertion of the gluteus maximus.

The lower edge of the buttock is defined by a pronounced crease, the *gluteal fold*, which is very deep on the medial side and diminishes as it moves laterally. This is caused by the presence of the fleshy fibers of the gluteus maximus on the lateral side. The lowest of these descend towards the thigh, on which they sit (Figure 77).

The gluteal fold is slightly curved. It follows a horizontal direction and crosses the lower edge of the gluteus maximus, which lies obliquely downward and outward. Thus, anatomists in the past have wrongly established a relation of cause and effect between the muscle and the form of the gluteal fold.

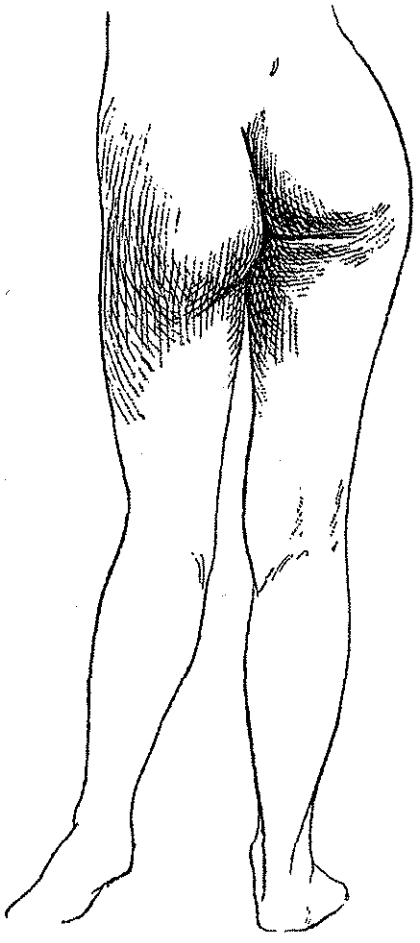

Figure 78: Gluteal fold in hipped posture

The first cause of the gluteal fold is the existence of strong fibrous tracts (Figure 79) that unite the deep surface of the skin to the ischium here. Thus, a close connection exists between the cutaneous fold and the pelvis, which makes one follow the movements of the other. This explains the shapes of this region in the hipped pose (Figure 78). On the side of the standing leg, the gluteal fold is caused by the ischia, digging in deeply from above and making a kind of lock that solidly grips the root of the limb at its medial part. On the opposite side, it follows the movement of the pelvis as it tilts downwards and makes the gluteal fold descend lower, which tends to erase it.

Another consequence of this anatomical disposition is that the fat of the region is contained in a sort of fibro-cutaneous pouch, closed at the bottom by the fibrous connections that join the skin to the ischium. This prevents the fat in this area from descending towards the thigh and augments the projection of the buttock. The existence of this pouch is conclusively demonstrated when, with the disappearance of fat in the progress of age, the lower medial corner of the buttock appears empty and withered (Figure 80). In this same pouch, one finds a part of the fleshy mass of the gluteus maximus, which in complete relaxation, falls downwards and medially under the influence of gravity.

The attachments between the gluteal fold and the ischia exist only in the medial part, where the fold is deep. From the lateral side, as I have said, the gluteal fold disappears before arriving at the outside plane of the thigh. It is replaced by an inclined plane that descends towards the thigh and makes a transition between the two neighboring regions. This inclined plane is caused by the lower faschia of the gluteus maximus itself.

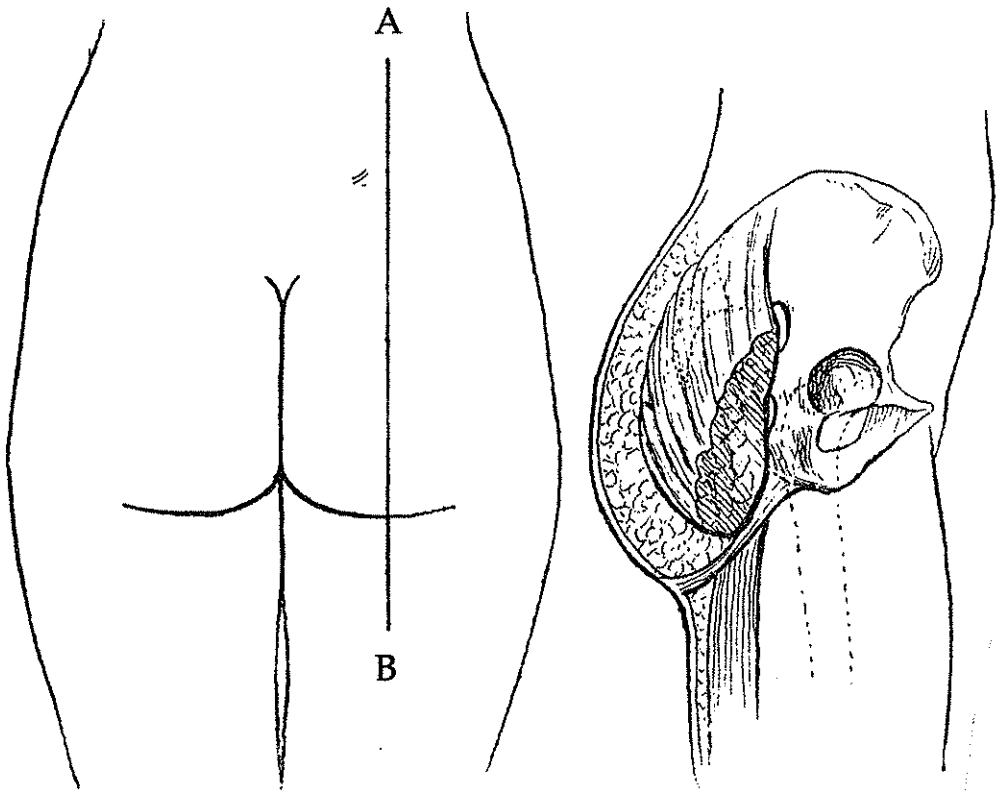

Figure 79: Anatomy of the gluteal fold

Anterior-posterior section along line AB showing the fibrous tracts that join the deep surface of the skin to the ischia, thus forming the fibro-cutaneous pouch in which we find the gluteus maximus muscle and the fat deposit of the region.

Great variations exist regarding the accentuation of the gluteal fold. In certain subjects it disappears almost completely, while in others it is very deep and long. Sometimes it is even doubled so that a second gluteal fold appears a bit below and outside the first.

We will see later how the orientation of the pelvis itself influences the morphology of the gluteal fold.

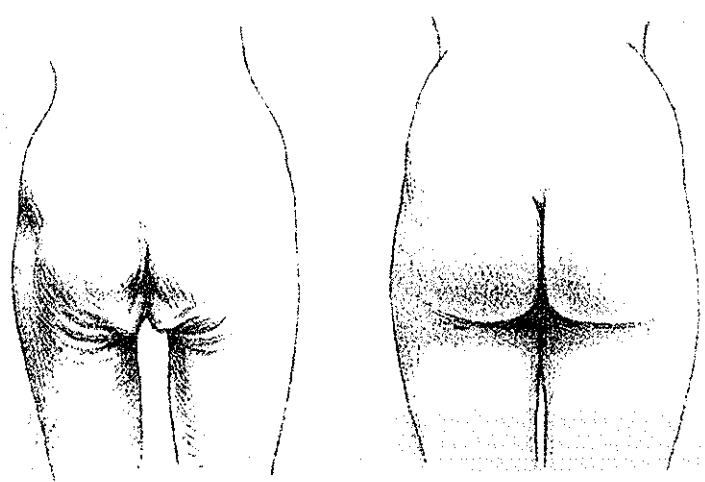

Figure 80: Region of the buttocks in an old woman and a young woman.

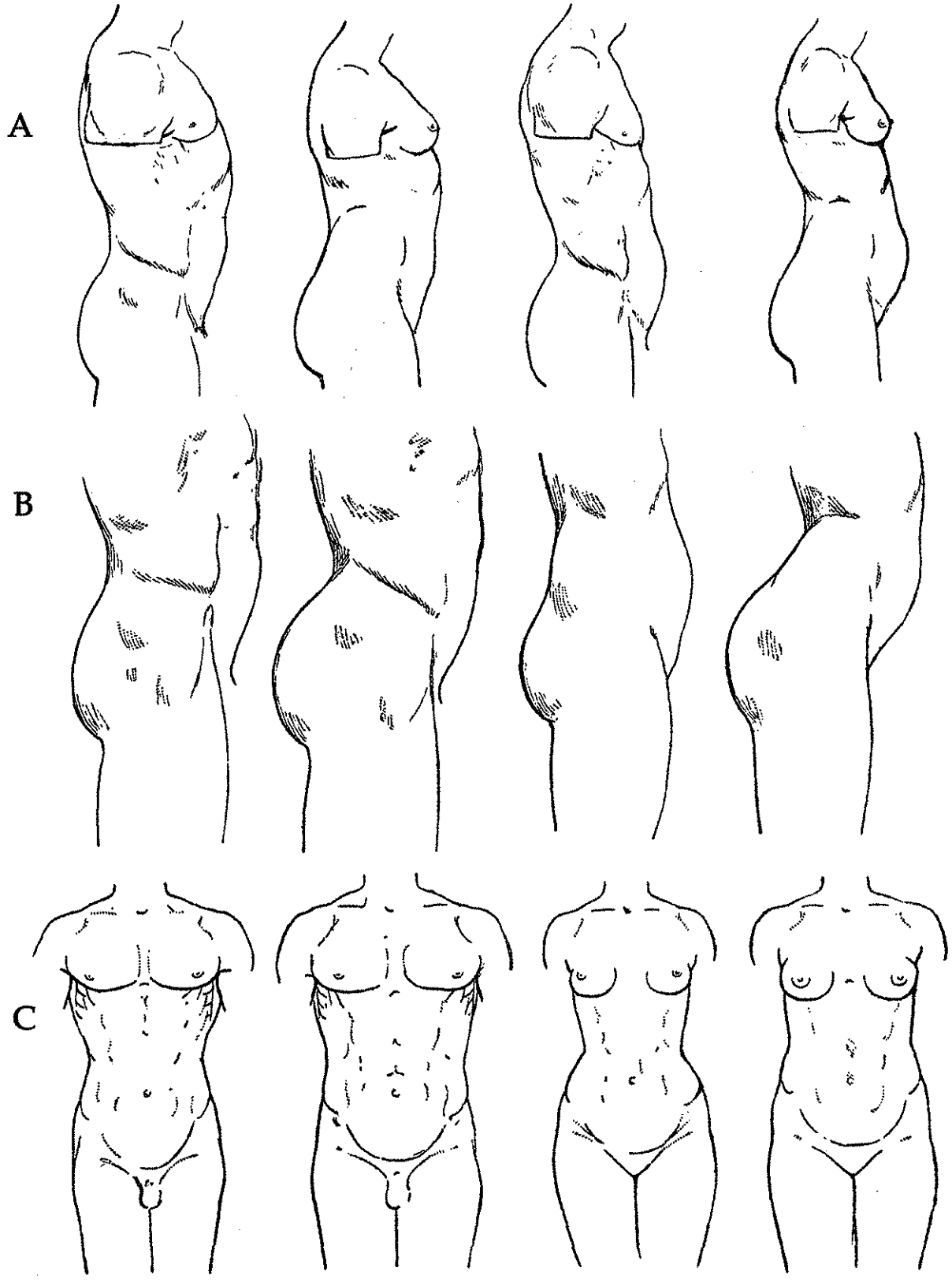

Figure 81: Several types of torso, in men and women

A. Thoracic type and abdominal type

B. Straight pelvis and inclined pelvis

C. Hourglass figure and straight figure

V. On the Many Variations of the General Shape of the Torso

Figures 81 to 85

We have seen that, as a result of the inverse development of the superior and inferior halves of the torso, the masculine form corresponds to the thoracic type and the feminine form to the abdominal type, while always maintaining the correct harmony of proportions. However, this balance can be upset in two different ways by an exaggeration or by a reversal of the typical characteristics.

An exaggeration will drive the man towards a more accentuated thoracic type and the woman to an equally more pronounced abdominal type. The reversal of characteristics will give the man an abdominal type and the woman a thoracic type.

A. Masculine Thoracic Type

Figure 81, A

This type is encountered in certain athletes, when an exaggerated development of the thorax is surrounded by powerful musculature, coinciding with a narrow pelvis.

I have had the opportunity to observe several examples of this body type. This conformation is favorable for exercises on the high bar, the trapeze, or the rings because the great force generated by the upper limbs, as well as the muscles that have their points of support on the thorax, is combined with the relative smallness of the pelvis, and often at the same time of the lower limbs, causing a reduction of weight to lift. It exists rather frequently in people of African descent, in whom the narrowness of the pelvis is the rule.

B. Masculine Abdominal Type

Figure 81, A

There is no question here of the man who is obese with a large belly, of whom Silenus is an example. But in certain weaker individuals there is a flattening of the chest and a development of the abdomen that also leads to the type in question. Certain young models present this conformation, which disappears with an appropriate diet and increased strength.

At other times, I have seen models in whom the exaggerated development of the pelvis and the very average development of the thorax gives a feminine appearance.

C. Feminine Thoracic Type

Figure 81, A and Figure 82, D, E, F

This conformation is especially rare. I will only point out that these women with wide shoulders and a narrow pelvis are a kind of virago with few feminine attributes. But outside of this type, which one could consider abnormal, there are women who present a remarkable development of the thorax while preserving everything appropriate in the pelvic region with truly feminine qualities. It is from this category of models that the artists of Antiquity drew the remarkable type of their Venus. Indeed, the antique Venus joins a pelvis of very feminine form, capable of bearing children, with a powerful thorax that supports a square waist with an athletic back and shoulders.

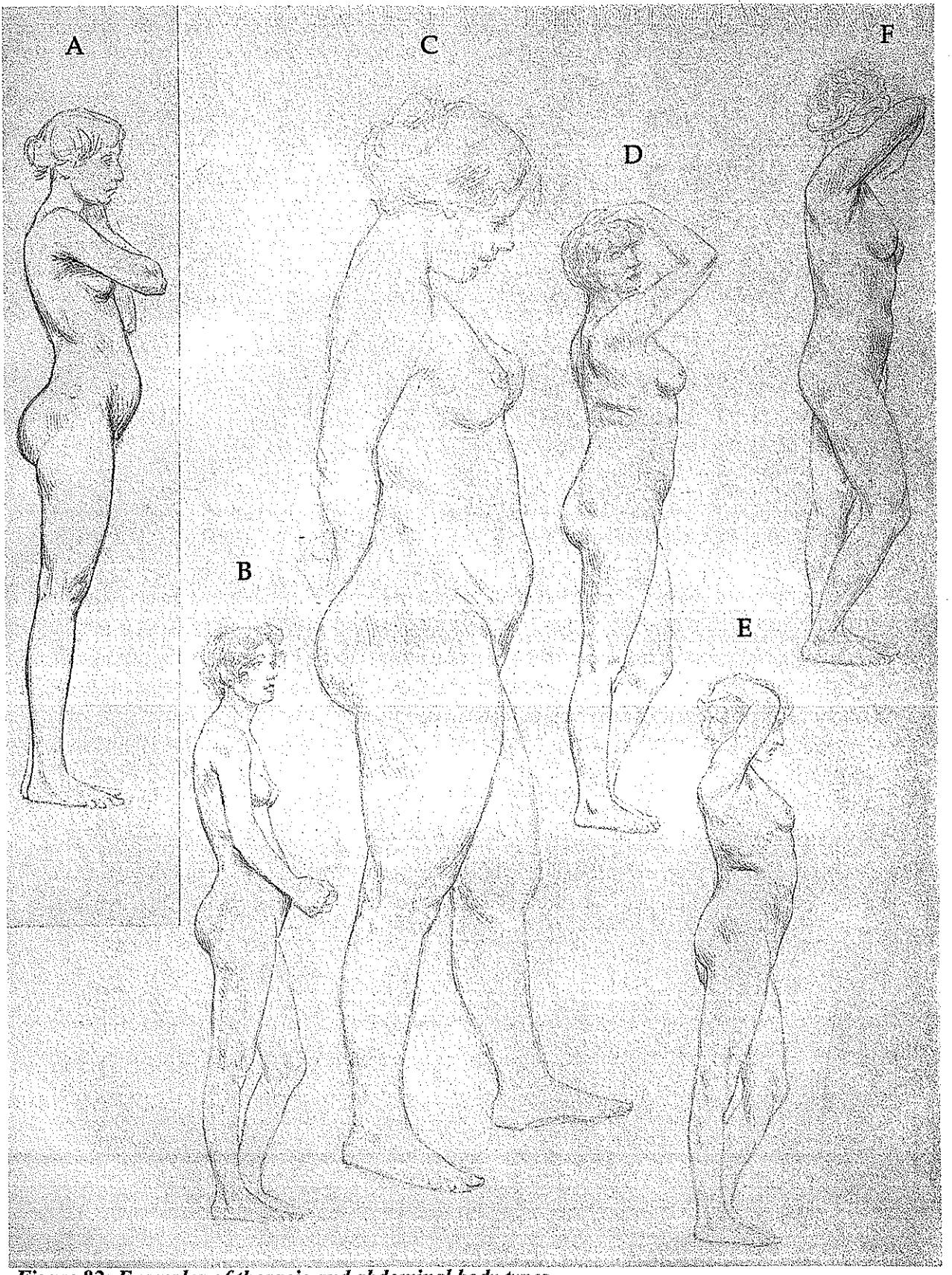

Figure 82: Examples of thoracic and abdominal body types

A, B. Abdominal body type showing a slight arch of the back in two frail young girls.

C. Abdominal body type in a solid young girl with moderate weight development.

D, E, F. Three thoracic body types in subjects of different ages.

D. Feminine Abdominal Type

Figure 81, A and Figure 82: A, B, C

As we just noted in men, it happens that in certain young girls who are weakened by growing too rapidly, or by bad hygienic conditions, one sees the back round itself and the abdomen protrude. This is, then, a transitory form, which is destined to disappear with age and the return of strength. However, this conformation is also often observed in adult women and in this case, constitutes a persistent and well-defined type. It is characterized by the predominance of the lower half of the torso, thus accentuating the normal feminine type. The abdominal type is exemplified by a relatively small thorax combined with a round back, falling shoulders, and small breasts placed high. These features contrast with ample hips and the projection of the abdomen underlined by a prominent mount of Venus, a consequence of a pelvis that is rather straight, which makes the sacral region almost vertical and the gluteal fold very deep.

The Italian Renaissance has given us an image of this form in which we understand its delicate charm and grace. But it can also be a bit unhealthy if one considers the fact that Botticelli used the beautiful Simonetta for the model of his Venus, who realizes this type most completely, yet who died of pulmonary consumption at the age of 22. The profile of a similar figure is a perfect realization of the serpentine line mentioned by Leonardo da Vinci. A curvature of the upper half of the torso is followed by a curve in the opposite direction through the abdomen and pubis, and continued by a new opposite inflection that creates hyperextension of the knee in the lower limb. To complete this tableau, we observe slightly long hands with tapered fingers, feet that are very loose and also a bit long, with long toes, the second toe clearly passing the others. This is the ideal type on which the Renaissance modeled the majority of its female figures, whether they are clothed or nude. In Germany, this type becomes heavier and crude with Albrecht Dürer; it goes to the limits of exaggeration and falls into ugliness with Cranach and many others.

This Renaissance form of the feminine nude is still found today, and if pure and complete examples are rare, a discerning eye will detect numerous traits scattered more or less through a great number of subjects. What one encounters most often is the development and projection of the abdomen with the straight pelvis. These features determine the essential traits of this figure and suffice to constitute the abdominal type in question.

E. The Inclined Pelvis and the Straight Pelvis

Figure 81, B

We know that normally the pelvis is always inclined in men as well as women, though to a more marked degree in women. But, according to the degree of inclination, the forms of the region vary. And two different types, opposites in a sense, are created at the two extremes of the scale of inclination. I shall refer to those in whom the pelvis is less inclined as having a *straight pelvis,* and those in whom the pelvis is more inclined as having an *inclined pelvis.*

The upright position of the pelvis has the effect of projecting the abdomen forwards. It often happens that this type coincides with the abdominal type, which I have already mentioned. However, it is also quite conceivable that, in certain young subjects who do not have much fat, the straight pelvis does not necessarily accompany a projection of the abdomen. The straight pelvis may be more common among men than women.

The following pages summarize the relief of the abdomen in both genders.

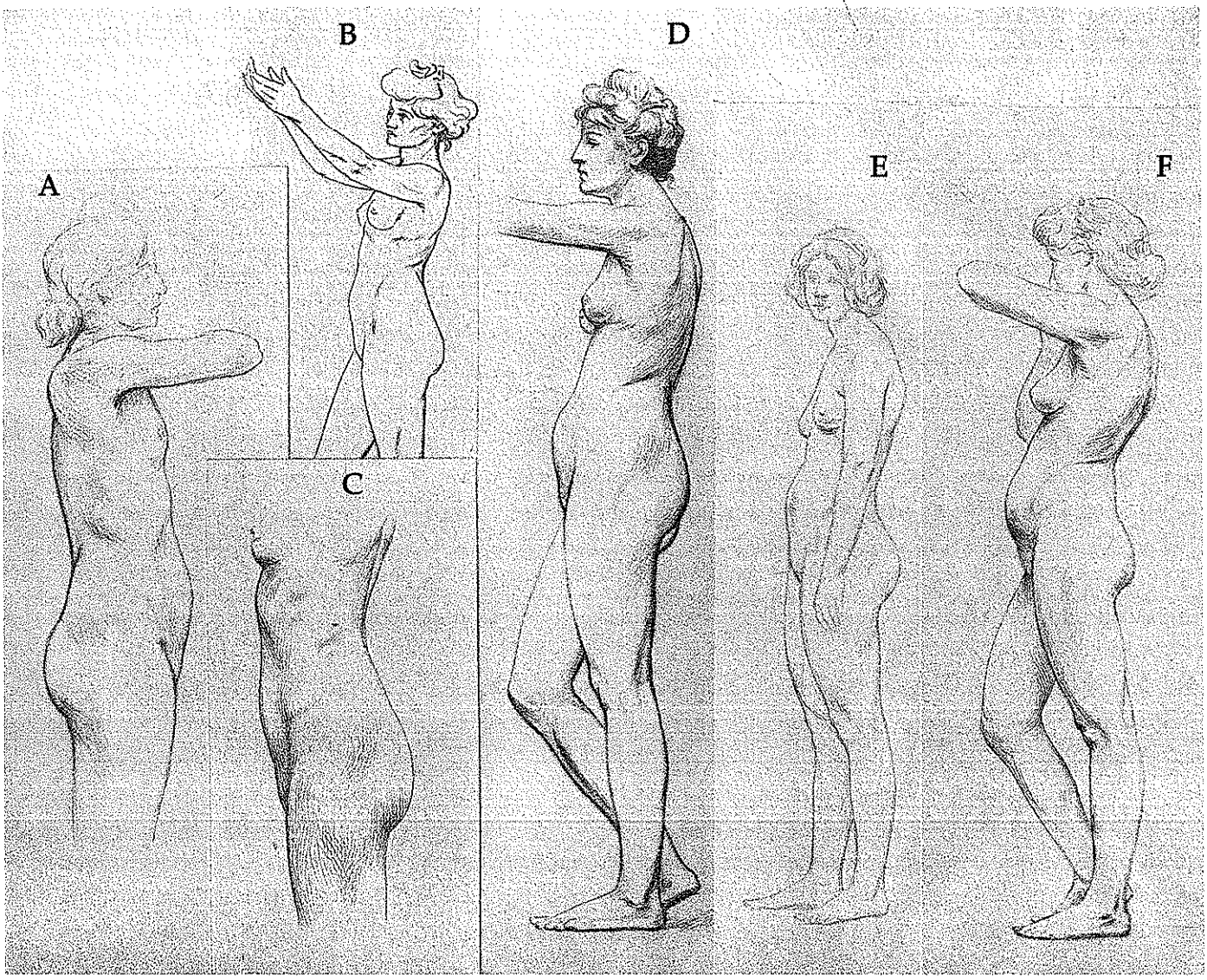

Figure 83: Several examples of a straight pelvis

The straight pelvis does not necessarily lead to the flattening of the region of the buttock, although this conformation, seen in B, C, and D, occurs frequently. The projection of the buttock varies: see examples A, E, and F, and depends on the amount of fat accumulated in the region. The same is true of the abdominal projection, which does occur frequently, as in A, D, E, and F, but is not constant. For example, you will see that the abdomen does not project in B and C. The mount of Venus, which always appears in profile, seems to be exceptionally prominent.

The straight pelvis will show the following traits (Figure 83):

- The iliac line draws its undulating shape in a nearly horizontal plane.
- The pubis projects between the roots of the thighs and appears clearly in profile
- The sacral surface approaches vertical
- The buttocks are flattened
- The gluteal fold is always very deep and accentuated

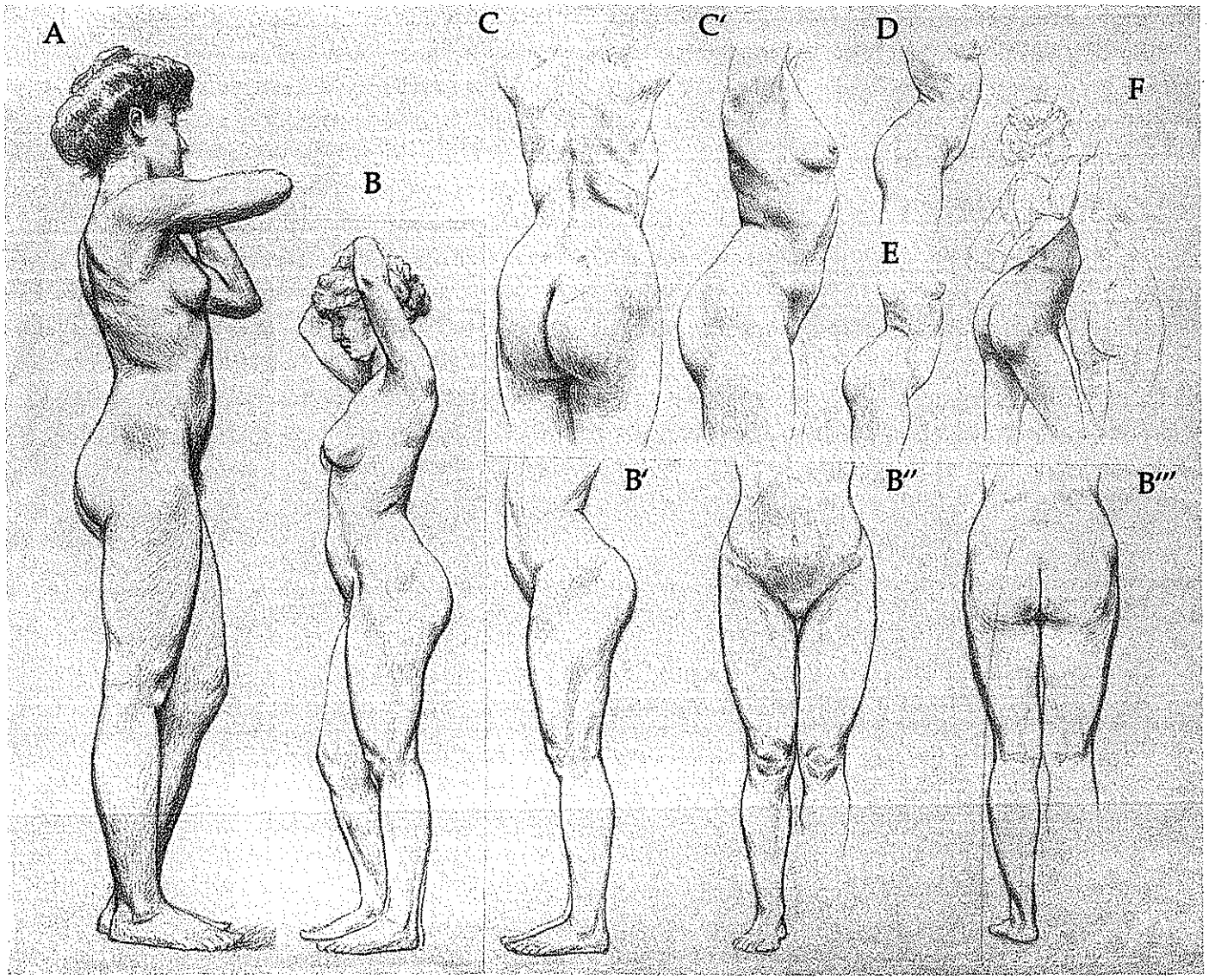

Figure 84: Several examples of an inclined pelvis

A. Pelvis with average inclination

B, B', B", B‴. Inclined pelvis showing the following morphological characteristics: inclination of the sacral region, projection of the buttocks, disappearance of the gluteal fold, flattening of the abdomen, the mount of Venus retreating between the root of the thighs and barely visible in profile

C, C'. Another example of the inclined pelvis showing the same signs as the preceding subject, and on whom we also see very clearly the accentuation of a deep crease that limits the flank from above and behind, as well as the inclination of the iliac line.

D, E, F: Examples of the extreme inclination of the pelvis

In contrast, the inclined pelvis will show these traits (Figure 84):

- The pubis moves back and is effectively eclipsed between the roots of the thighs
- The iliac line is very oblique
- The sacral surface moves away from the vertical
- The lumbar arch is pronounced
- The buttocks project and the gluteal fold is faint, sometimes disappearing entirely
- The abdomen is most often flattened or subtle in shape

When we examine a subject regarding the orientation of the pelvis, we must first consider that, in standing posture, the position of the pelvis has nothing stable or absolutely fixed about it. The model can easily change the tilt of his or her pelvis at will. It is certain that the influence of posture, dictated often by fashion, can play a role in the orientation of the pelvis. But, the subject's natural conformation, which cannot be changed, plays the most important part in the orientation of the pelvis, as indisputably proven by Charpy's observations from the cadaver.

However, there is a very simple means of assuring one's self of the sincerity of the live model's posture (Figure 85). It suffices, for example, to ask the subject to kneel or to lie down on a rigid horizontal plane, such as the floor or a plank. It is not likely that they could know the influence of these new positions on the inclination of their pelvis. In the kneeling posture, the pelvis is always more inclined. It is less straight, if it has already been seen to be straight in upright posture; it is more inclined if it is the inclined type. But when the subject lies down on a rigid flat plane we see the most decisive signs. In those with a straight pelvis, the posterior part of the torso touches the ground at all its points. In those with an inclined pelvis, to the contrary, the loins are elevated to a greater or lesser degree and move away from the plane on which the buttocks and the back rest, forming a kind of bridge.[42]

Figure 85 (right): Straight and inclined pelvis in standing, kneeling, and supine posture

A, B. Inclined pelvis

C, D. Straight pelvis. On these four figures, the dotted lines indicate the inclination of the sacral surface from the vertical, and show that in both cases, this angle is always greater when kneeling than when standing.

E. The straight pelvis in supine posture

F. The inclined pelvis in supine posture

[42] Text removed to Appendix III

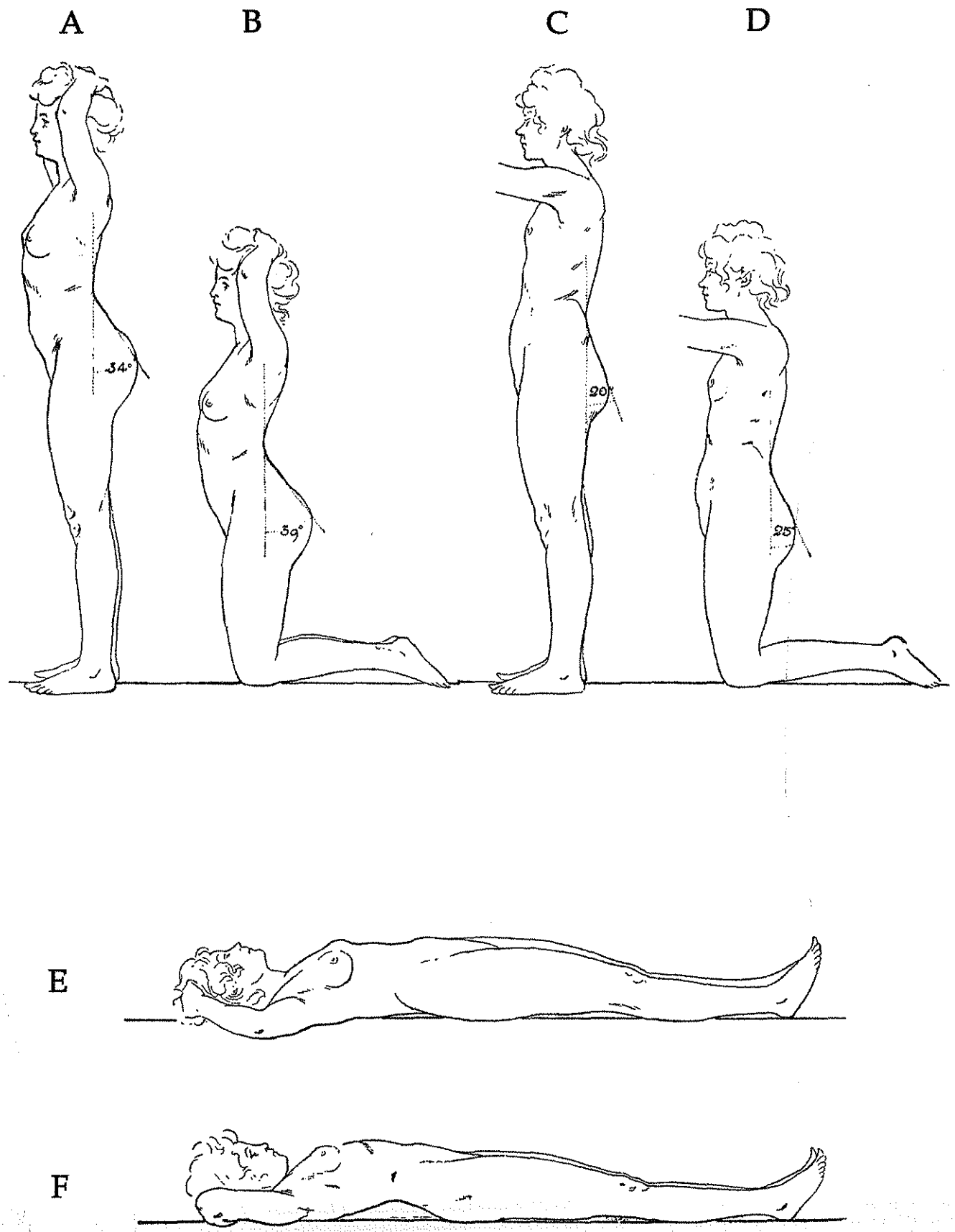

Figure 85: Straight and inclined pelvis in standing, kneeling, and supine posture

F. The Hourglass Figure and the Straight Figure

Figure 86

It is men who have their waist marked as if their torso was imprisoned in a corset. This conformation coincides most often with a pelvis that is relatively narrow, and it is the result of a natural narrowing of the lower half of the thorax. When it is not exaggerated, it has a quality of incontestable elegance but in no case could it indicate a very robust constitution. The Renaissance endowed certain masculine nudes with this form, which is demonstrated by some very curious figures from the '*Tres riches heures du duc du Berry.*'

In women, a similar conformation may occur naturally and is not always due to the abusive usage of the corset. I have observed several examples (Figure 86) and Dr. Stratz published the photograph of a girl from Java who had never worn a corset.[43] She presented this constriction at the middle of the torso, as well as a wide development of the upper part of the thorax and a beautiful fullness to the whole pelvic region. Putting aside the cases when the accentuation of the waist is due to the abuse of the corset, this conformation is more common in women than men, which sufficiently explains the normal elongation of the woman's ribcage and the narrowing of its lower half.

But the straight figure, which is not at all marked by a constriction at the waist, also exists as much in women as in men. In women, whose ideal has been the wasp's waist for a long time, this conformation has been given the pejorative name the *square waist.* But, it should not be less favored than the hourglass form. In men, it calls for a fullness of the pelvis that indicates a solid and robust constitution, while in women, it requires a thorax that is well developed, opens wide at the bottom, and has a very open xiphoid angle (Figure 86).

Regarding the aesthetic value of the straight figure, it suffices for me to point out that this is the preferred form of the antique Greeks, with which they endowed their athletes and their figures of Venus. At that time, the body was developed freely in the gymnasia and clothed with floating draperies. The Greeks did not submit to the damaging constraint of clothing like women did in the Renaissance. Thus, the type of feminine nude created in antiquity differs significantly from the nude of the Renaissance and the modern day.

The straight figure has a full back and broad shoulders, a pelvis of average inclination, and regular projections of the abdomen and the buttocks. To complete this tableau, let us add moderately developed fat deposits that serve to join neighboring regions of the body imperceptibly, creating a harmony of lines and a happy equilibrium of planes.

This antique type, of which fine examples can still be found today, sometimes hidden under the most humble garments, is the most complete expression of the physical strength and health that creates it. She is placed as an eternal standard between the modern ideal and that of the Renaissance, which are both only variations on her form, in opposite directions and to different degrees (See Appendix I: Tres in Una).

Figure 86 (right): Several examples of the hourglass figure and straight figure
A, A', and B, B'. Torso constricted at the waist in two subjects who have never worn a corset
C, D, E, E'. Three examples of a straight torso with a square waist

[43] La beauté de la femme, p. 85, fig. 2

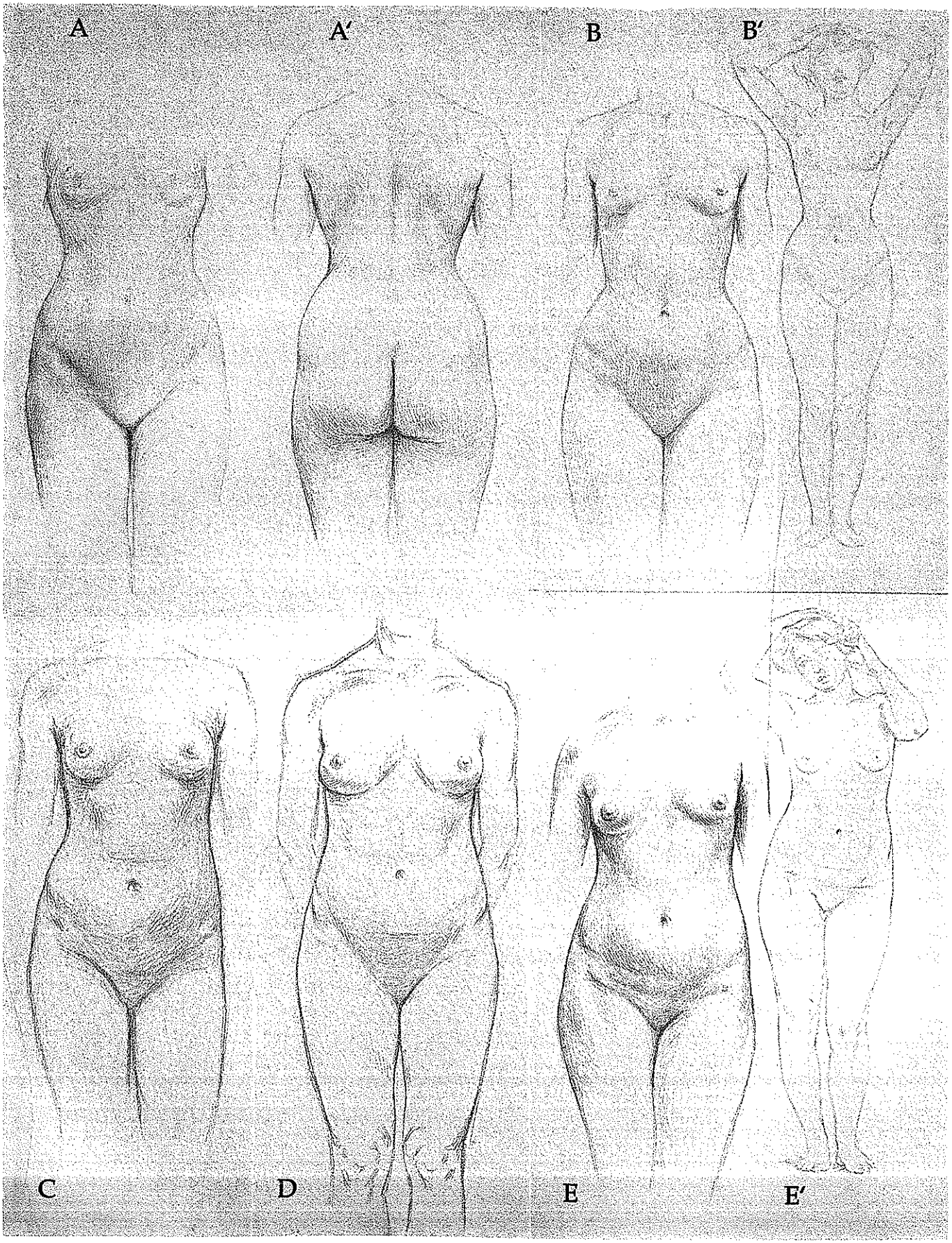

Figure 86: Several examples of the hourglass figure and straight figure

VI. Upper Limb

As for many other parts of the body, the woman's upper limb is a simplification of that of the man, with the persistence of the fundamental morphological elements. However, to transform a masculine arm into a feminine arm, it will not suffice to round it and remove its muscular relief. In women, the forms persist more simply, more finely, more delicately, and are more difficult to grasp. This is why it seems helpful, more so for the upper limb than for elsewhere, not to separate the feminine morphology from the masculine, but to combine them in the same description. Thus, the two studies mutually support each other and each one clarifies the other.[44]

Some particulars must be stated first. In this region, I will distinguish *fixed forms* from *variable forms*.

The fixed forms remain more or less the same in all subjects: on thin men, on women, as on the most muscular athlete. These forms are either of a deep origin, or a very superficial one. They are determined by the skeleton or by cutaneous folds.

The variable forms change from one subject to another with muscular development or the degree of weight. They depend on the muscles or on fat. But their variations are always made along the same lines and will obey a certain law. Amongst the variable forms, one should also include the shapes of the veins, although this will not be discussed here.

To summarize, we will distinguish:

The *fixed* forms	***vs.***	**The *variable* forms**
Bony forms & Skin forms		Muscular forms & Fat forms

In current language, artists often speak of the *contour* and the *plane*. The meaning of these words needs to be specified more precisely. We will take them to mean the following:

- The *contour* is the ideal line that follows the edge of any part of the body, in whatever aspect that part is observed. The contour merges with the profile.
- The *planes* are the various surfaces of the form that are contained between the opposite profiles of a part. The planes create the contour.

As a result, planes and contours coincide and only happen to be differentiated by observing them from a different orientation. A succession of planes becomes the contour when it is seen from the profile.

Artists have wanted to create a sharp distinction, or at least an independence, between the contour and planes on one side and the anatomy on the other. The contour and planes have been seen as the essential elements, fundamental to the form, while the anatomy only intervenes to furnish the outline with superficial morphological details of secondary importance. This is a misconception, because the anatomy is truly something profound. It is what creates the whole form and simultaneously realizes the contours and the planes, which is to say, all the irregularities of the surface.

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[44] I will not repeat the detailed description of the various regions of the body already stated in my *Anatomie*, to which I advise the reader to refer. This reading could only be an excellent preparation for the understanding of what will follow.

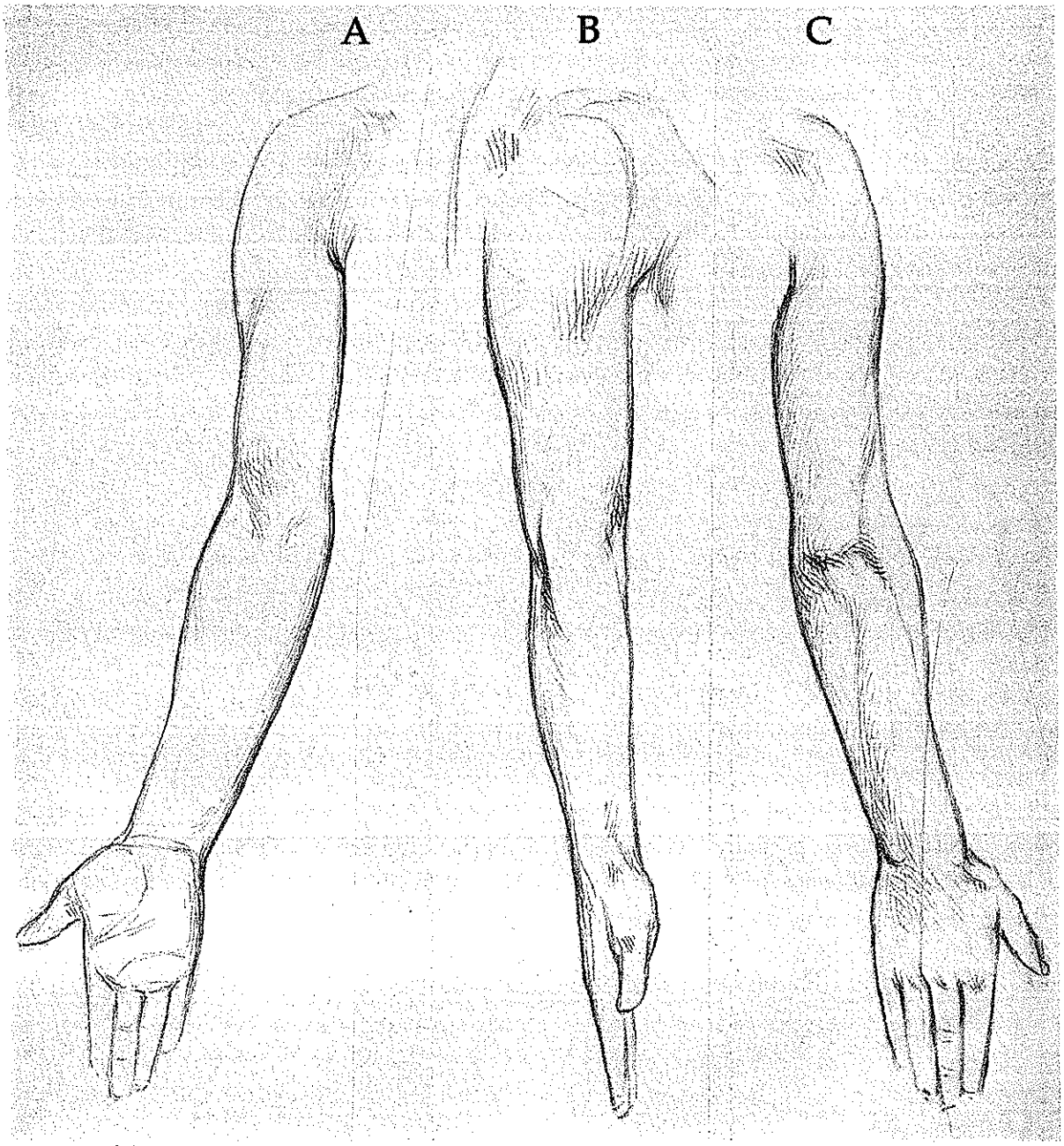

Figure 87: Feminine upper limb
A. Anterior view B. Lateral view C. Posterior view

I will first consider the upper limb in the posture of supination from different aspects.

The first rudiment of the form is determined by the sequence of the axes of the different segments that make up the upper limb: arm, forearm, and hand. The axis of the arm will be approximately vertical in the chosen posture (Figure 88, B). In this case, the axis of the forearm tilts downwards and to the outside, making an obtuse angle with the axis of the arm, opening to the outside. The axis of the hand goes in an opposite direction and describes, with the axis of the forearm, an obtuse angle opening to the inside.

Now, I do not need to restate the anatomical causes of the different directions of the axes of the segments of the upper limb in the supinated posture. Several authors have argued that this outward deviation of the axis of the forearm constitutes a deformation in women. This is incorrect. The extent of this deviation is rather variable in different

subjects, and while its exaggeration is certainly to be avoided, I have always observed it to a moderate degree, even in the most beautiful feminine models. One could consider a normal deviation of the forearm to allow the extension of the axis of the upper arm to pass along the inside edge of the wrist, or a bit inside of it.

From the lateral view (Figure 90, B), a single straight line represents the axes of the different segments of the upper limb, which continue without changing direction. It should always be noted that, in women, a backwards deviation of the axis of the forearm is the rule. It is caused by an exaggerated extension of the elbow, which I refer to as *hyperextension*, and which will be examined later.

To best attain the goal I am pursuing, which is to shed light on the close relationship between the feminine and masculine forms, we will first consider the simplest feminine limb; that which is reduced to forms that are, so to say, fixed and elementary. By a series of transformations, we will arrive at the most complex form of the athlete whose muscles are well sculpted.

A. Feminine Upper Limb

Our attention will turn to the two elements of the form described above: the contour or profile, and the planes contained within these profiles. We will consider them from the three principal points of view: the anterior, posterior, and lateral view.

1. Anterior view

Figure 88, A

Profiles: The medial profile begins along the inner arm with a very subtle convex line; it is nearly straight, and culminates in the projection of the medial epicondyle. This line continues into the forearm as a new curve with two subtle inflections, the first broader than the second. It arrives at the indentation below the distal ulna at the wrist and ends with the convexity of the heel of the hand and the contour of the fingers. On this contour, the medial epicondyle clearly marks the limit between the arm and the forearm.

On the lateral contour, a precise separation does not exist between the arm and the forearm. This contour begins with the curvature of the shoulder supported by the deltoid muscle, which ends at the depression of the deltoid's insertion on the arm. Along the arm itself, the profile translates into a straight line, which is followed by a long double-inflection curve circumscribing the forearm, as at the medial profile, but with the following differences. The first inflection begins higher; it begins above the elbow at the lower part of the arm, and is more pronounced. The second inflection is much smaller than the first; it ends in the depression below the distal radius at the wrist, where the root of the thumb begins.

On these profiles, we can identify some fixed points that do not change regardless of the degree of muscular development: the projection of the medial epicondyle, the depressions on the sides of the wrist below the distal ulna and distal radius, and the deltoid depression at the insertion of the deltoid on the humerus.

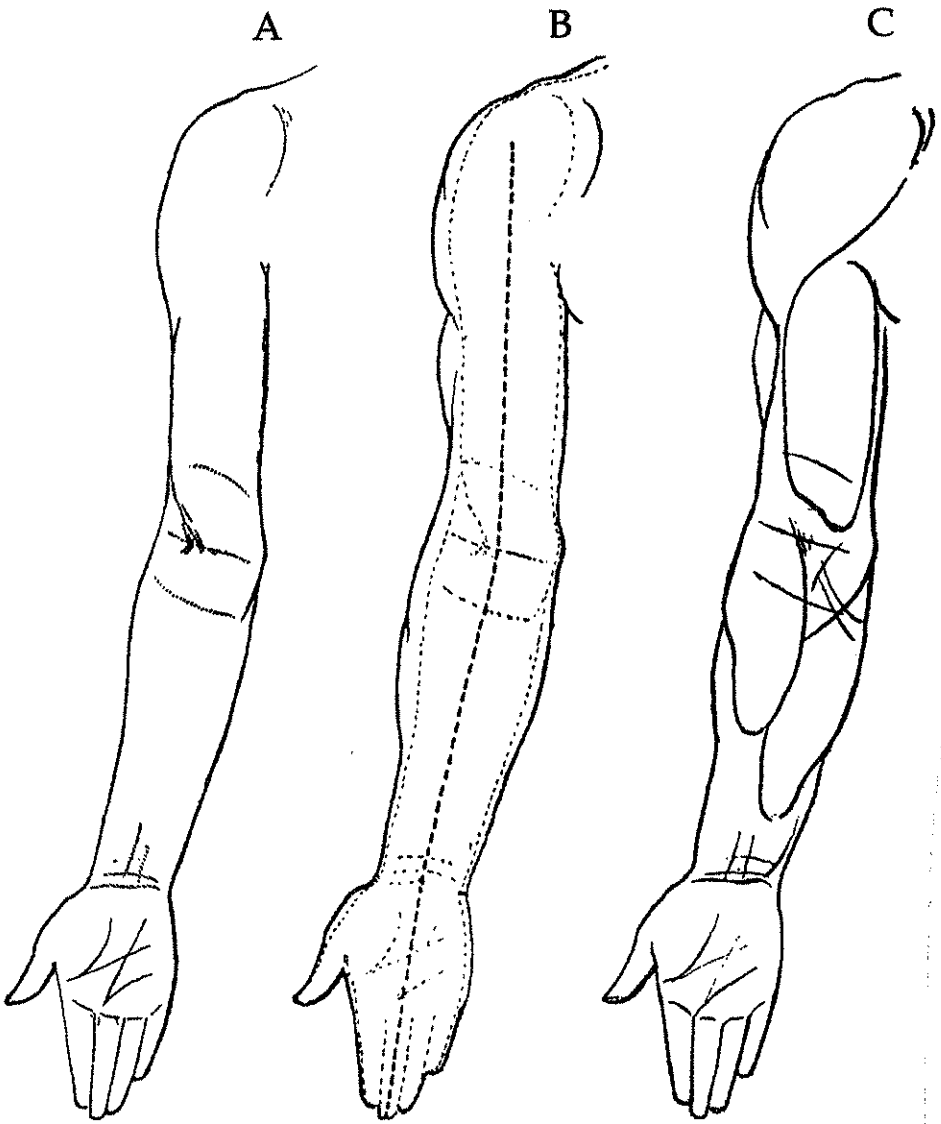

Figure 88: Anterior view

A. Upper limb of a young girl

B. Superposition of A and C with the axis of the different segments of the limb

C. Upper limb of a muscular man

Planes: Between these contours, one observes several simple planes on the limb in question. However, these planes are variable because they lie on the muscles and skin folds that are attached over the joints. First of all, in the upper arm, the rounded surface of the biceps flattens itself in front of the elbow. Then, the anterior side of the elbow is divided by an oblique flexion fold. As you follow the trajectory of this flexion fold, you arrive at a fossa that is carved outside of the tendon of the biceps. This is the *fossa of the anterior elbow*, or *cubital fossa*, corresponding in depth to the radio-humeral articulation. This fossa is accentuated on fat individuals and on women, while the other morphological features tend to be diminished. This fossa is therefore one of the most fixed forms of the region. Besides this, one distinguishes two other secondary flexion folds that are superficial but also constant. They are directed transversally and a slight degree of flexion of the elbow makes them evident. Both flexion folds have a curvilinear direction whose concavity looks toward the center of the region. They are situated at some distance from the first; the upper one traverses the projection of the biceps several centimeters above the tendon; the lower one crosses the anterior surface of the forearm.

The upper half of the forearm is occupied by a wide, flat plane that rests on the plump bellies of the muscles of the region, which are variable according to their degree of muscular development. This plane ends above the wrist with tendinous projections that cannot vary much between individuals. These two tendinous projections have the shape of longitudinal cords and are created by the two palmar tendons. They do not follow the axis of the limb exactly, but head slightly diagonally downward and laterally. The internal cord is more slender and at the same time, more projecting. It belongs to the palmaris brevis, a muscle that is missing in one individual out of ten. It lies near the middle of the region. Moving past palmaris brevis towards the ulnar side of the wrist, we find a depressed surface that corresponds to the tendons of the flexors of the fingers. This area leads to the tendon of the flexor carpi ulnaris situated along the ulnar side of the wrist and often replaced, especially on women, by a longitudinal depression caused by the projection of fat accumulated here. Outside of the tendinous form of the palmaris longus is a wide, shallow channel where one feels the distal end of the radius. It is bordered on the lateral side by the extensor tendons of the thumb.

To these tendinous forms, we add the flexion folds of the wrist, of which there are three. The lower fold is most pronounced and borders the heel of the hand from above. It is angled downwards and outwards and describes two undulations. The middle fold, situated about a centimeter above, describes a slight curve of downward concavity. Finally, the upper fold, placed highest, has a similar direction and happens to be the most superficial. It nevertheless becomes very evident with even the slightest flexion of the wrist.

The hand seen from the palmar side hardly varies from one person to another except by its volume, due principally to the development and proportions of its bony framework: more massive in men, more slender in women. But the forms of the palm, fixed as a whole, must be described here in some detail (Figure 93, A and Figure 96, C).

The palm of the hand is depressed in the center and rises along its edges in several projections of different shape and volume. The greatest is the thenar eminence, situated next to the thumb, and composed of two planes: the upper plane is prominent and ovoid in shape. It rests on the bony projections of the scaphoid and trapezium and corresponds to the muscular group of the root of the thumb, whose uniform relief is never subdivided. The other plane is situated lower; it is depressed and smaller in size, and corresponds to the outer extremity of the adductor pollicis, which is superficial here. On the opposite side of the palm we find the hypothenar eminence, caused by the group of musculature of the same name. It extends along the full length of the hand, continuing without precise limits into the central hollow of the palm on one side, and to the ulnar side of the hand on the other. Near the wrist, the thenar and hypothenar eminences join each other, converging to form the heel of the hand. This is essentially a fixed form because it is bony and created by the edges of the carpal tunnel: the scaphoid on the radial side, and the pisiform on the ulnar side. The pisiform makes a higher and more isolated projection. Below the heel of the hand, the two lateral eminences, thenar and hypothenar, diverge from the axis of the hand and thus circumscribe the hollow of the palm. An elongated diagonal projection, corresponding to the reliefs of the metacarpophalangeal joints, terminates the distal side of the palm. This projection is raised at both ends, conforming to the anterior concavity of the metacarpals. It is not uniform. In the extension of the fingers, it is marked by small cylindrical bumps that correspond to the interdigital spaces at each finger. They are caused by small fatty forms that are pushed out by the tension from the expansion of the palmar aponeurosis, which adheres closely to the deep surface of the skin.

The palm of the hand extends beyond the distal ends of the metacarpals since its bone structure includes the proximal ends of the phalanges that converge at the metacarpophalangeal joints. The distal edge of the palm is a large curved crease that separates it from the fingers; this crease corresponds to the middle of the proximal phalanges.

The palm of the hand is creased with numerous folds, however, they can be reduced to four constant forms: two principal and two secondary. They are created by the movements of flexion of the fingers and opposition of the thumb. The thenar eminence is circumscribed by a long curvilinear crease along the palm and the wrist. This is the *crease of the thumb*; it is accentuated in movements of opposition. Furthermore, in the flexion of the three last fingers, one sees a slightly curved transversal crease that lies a few centimeters from the base of the fingers. It originates on the ulnar side and ends between the index and the middle finger. This is the *crease of the fingers*. These two principal creases are accompanied by two more shallow ones. Alongside the crease of the thumb, a long longitudinal crease begins from the root of the hypothenar eminence and travels in a straight line towards the junction of the index and middle fingers. This is the *secondary crease of the thumb*. Another oblique crease begins from the distal end of the crease of the thumb and finishes around the middle of the ulnar side of the hand. This is the *secondary crease of the fingers*. The shape made by these different creases has been compared to a capital M. The outer lines are made by the crease of the thumb and the crease of the fingers, and the central V is represented by the meeting of the two secondary creases (Figure 93).

2. Posterior view

Figure 89, A

Profiles: The contours are naturally the same as they appear from the anterior view, so I do not need to revisit them here. However, the planes that fill these profiles demand a detailed description.

Planes: All of the upper part of the arm is occupied by a softened projection corresponding to the round forms of the triceps, whose individual segments do not appear very distinctly in the case of weaker muscular development. This projection is depressed at the bottom, above the elbow, in the region of the common tendon. Very often in women, a special fat deposit sits behind the insertion of the deltoid and extends over the whole upper part of the triceps. This fat deposit may be small or quite considerable in form. It can exist even in young girls, and should not be confused with the muscular relief of the triceps. On muscular women, one can recognize the lower part of the triceps beneath the fat deposit.

The elbow is the site of some very interesting fixed forms. Around the middle of the region, but much closer to the inside edge than the outside one, the olecranon makes just a slight projection in extension. Most often in women, a transversal crease forms here, which diminishes the olecranon's projection. This deep crease, which increases with the thickness of the subcutaneous fat layer and with the degree of hyperextension of the elbow, can dominate the morphology of this region. This crease leads to a deep dimple on the outside: the *fossa of the lateral epicondyle*. This form is remarkable for its constancy, situated at the lateral epicondyle of the humerus. At the bottom of this fossa, the humeral condyle and the head of the radius, as well as the space between them, can be felt very clearly. On its inside edge, the crease of the elbow stops in the groove that separates the olecranon from the medial epicondyle, through which the ulnar nerve passes. The fossa of the lateral epicondyle is located at the same level as the cubital fossa, described on the anterior side, and a probe inserted perpendicularly to one of them will come out at the other after crossing the radiohumeral articulation.

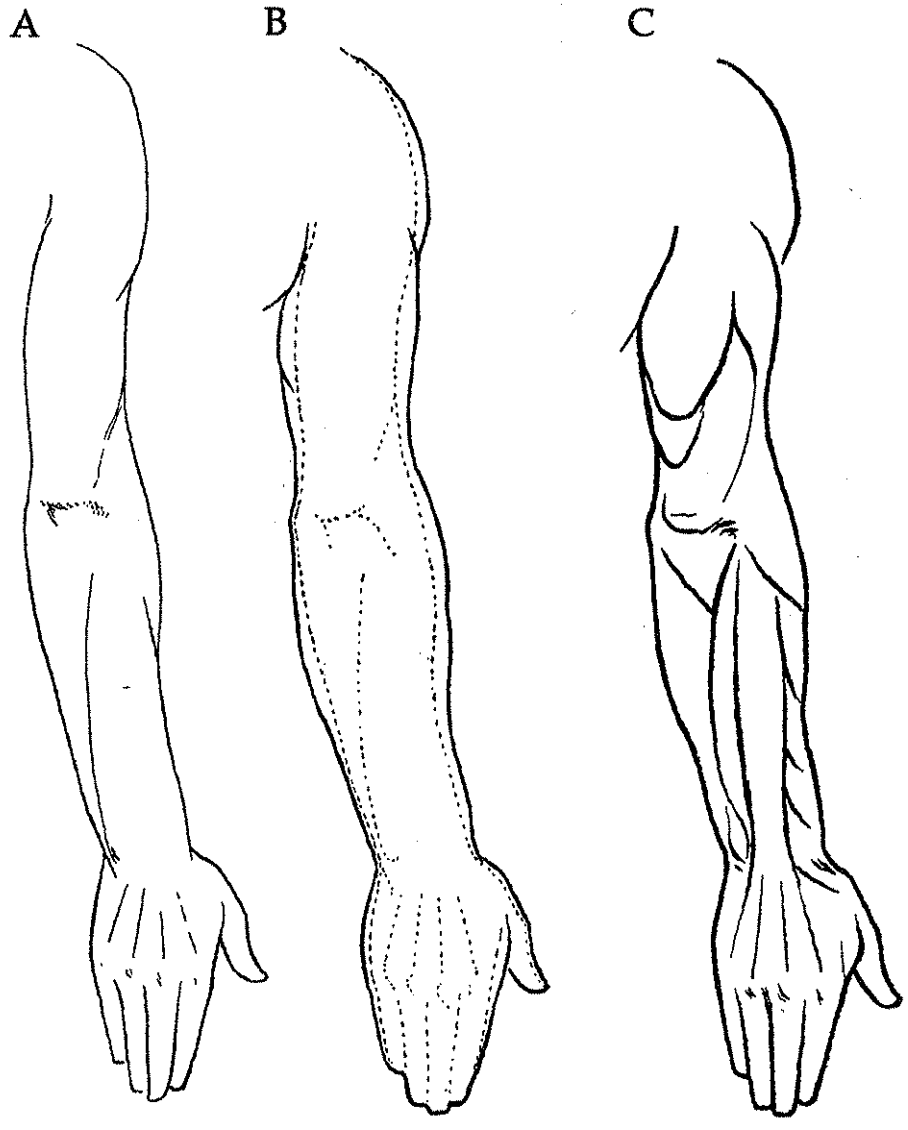

Figure 89: Posterior view

A. Upper limb of a young girl B. Superposition of A and C C. Upper limb of a muscular man

The projection of the lateral epicondyle is hidden in extension by the neighboring muscular reliefs, and only reveals itself during flexion of the elbow.

The general shape of the forearm is simple enough; it rises up at the top, over the plump bodies of the muscles, and is depressed at the bottom in the region of the tendons. It is always crossed at an angle by a long furrow, the *furrow of the ulnar ridge*, which may be reduced to a flat surface, but whose constancy is remarkable. This furrow begins at the *fossa of the medial epicondyle*, or a bit below it, and finishes above and medial to the styloid process of the ulna. It corresponds, in depth, to the ulnar crest (the posterior edge of the ulna) and is caused by two long muscular reliefs situated on either side: the extensor carpi ulnaris on the outside and the flexors of the fingers, which are covered by flexor carpi ulnaris on the inside. Its close relationship with the ulna makes this furrow a fixed bony form.

At the wrist, the lower ends of the bones of the forearm establish their fixed forms. On the outside, the distal end of the radius shows its wide projecting surface. On the inside and positioned higher, one sees the narrow and

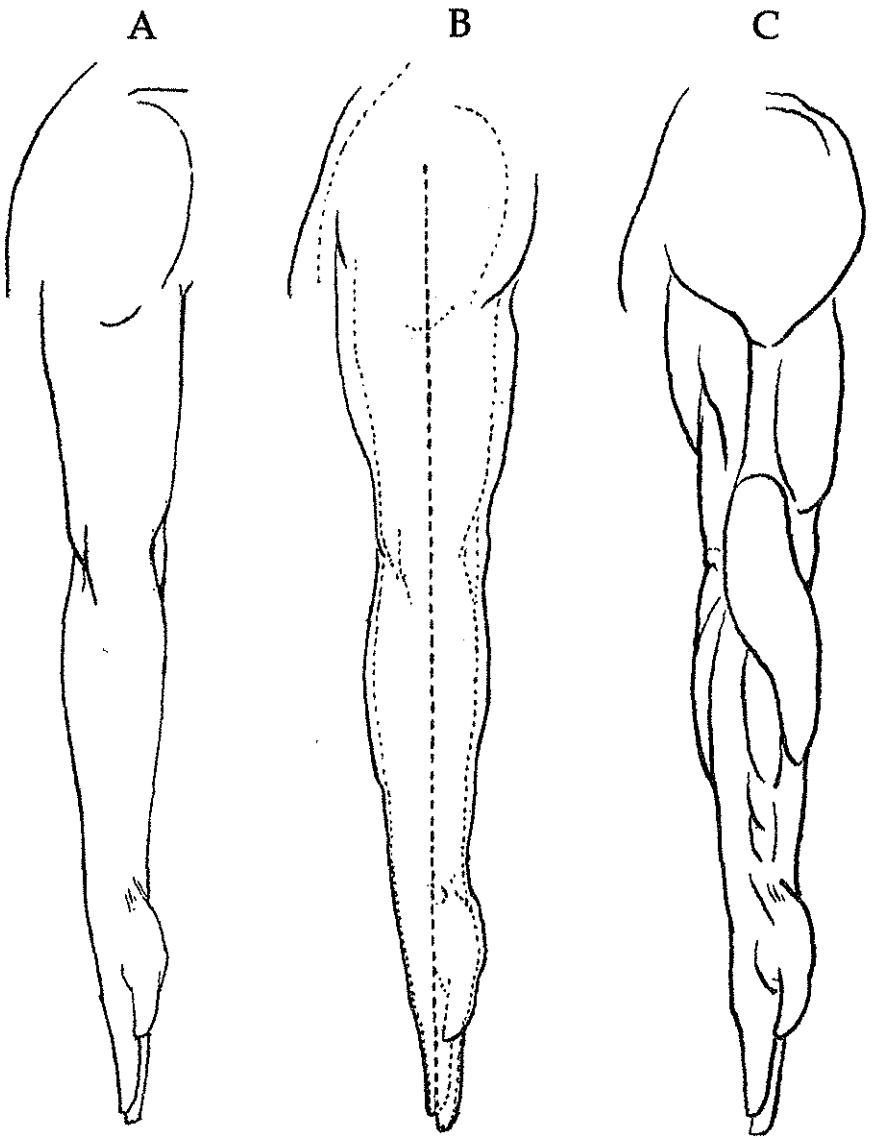

Figure 90: Lateral view

A. Upper limb of a young girl B. Superposition of A and C, with the axis of the limb
C. Upper limb of a muscular man

sharply defined projection of the styloid process of the ulna. Finally, in the middle, the tendons of the extensor muscles, which we will find again in the hand, are contiguous to each other and do not make separate reliefs as they do lower down.

As a whole, the dorsal surface of the hand reproduces the general convex transversal shape of the metacarpals. The highest part corresponds to the third metacarpal, or the metacarpal of the middle finger. In addition to the irregular and highly variable projections of the veins, we can distinguish, in extension, the tendons that go from the center of the wrist to diverge toward each finger. The back of the hand is marked by the individual projections of the metacarpophalangeal joints, where the skin folds transversally. On hands that are a bit chubby, the tendinous projections disappear and the metacarpophalangeal articulations are each marked by a characteristic dimple (Figure 96: A, B). Between the thumb and the index finger, the intermetacarpal space is always filled by the muscular projection of the first dorsal interosseus.

3. Lateral view

Figure 90, A

Profiles: Now, as we consider the lateral view, we notice that its profiles are formed by the succession of planes that we have studied on the anterior and posterior sides, while the planes contained between these profiles correspond to the lateral contour that we discussed earlier.

In the middle of the posterior contour, we see a fixed point situated at the olecranon that marks the boundary between the upper arm and the forearm: the olecranon process.

The profile of the upper arm in back follows a curve that drops gradually as it approaches the elbow. In women, its upper relief is caused by the presence of a fat deposit, as mentioned earlier. The lower part of this curve sinks in as it rests on the tendinous part of the triceps. The profile continues on the posterior side of the forearm as a long, low, uniform curve that straightens itself bit by bit as it descends, to become a straight line at the wrist, the back of the hand, and the fingers.

In front, the profile follows the low projection over the middle of the biceps muscle and accompanies it until the cubital fossa. The profile continues at the bend of the elbow as a new straight line, or a very subtle curve, tangent to the relief of pronator teres.

The anterior contour of the forearm is rather similar to the posterior one because its musculature is similar: formed by the plump muscles above and the tendinous parts below. However, it differs from the posterior in that its upper curve is less pronounced, starts a bit lower, and the bottom of this curve not only straightens itself out, but sometimes curves in the opposite direction because of the straightening of the tendons that come to attach at the wrist. At the hand, the thumb is situated on an anterior plane, making its distinct profile in front of that of the fingers.

Planes: Between these two profiles, I will mention the following planes. First of all, below the relief of the shoulder is the deltoid depression, a fixed form, which is followed by a flat plane corresponding to the brachialis. Then, a rather pronounced relief overlaps the upper arm and descends to the upper part of the forearm. This relief, of a variable volume according to the degree of muscular development, is limited at the front and back of the elbow by two similar fixed forms; these are the two fossa of the region: the cubital fossa in front and the fossa of the lateral epicondyle in back. Above the wrist is a new elongated muscular projection of highly variable volume; these are the muscles of the thumb. Next to this form, there is a constant depression, a fixed and invariable form, bordered by the styloid process of the radius above and by the extensor tendons of the thumb on the sides: in front by the extensor pollicis brevis joined with abductor pollicis longus, in back, the extensor pollicis longus. This deep fossa, which becomes even larger with the extension of the thumb, has been given the picturesque name the *anatomical snuff box.*

B. Masculine Upper Limb

On a man's upper limb, no matter how muscular he may be, we will find the fixed forms that I described on the feminine arm. This is an interesting comparison to draw, and I will now consider the outlines and planes of a masculine form successively from the different points of view.

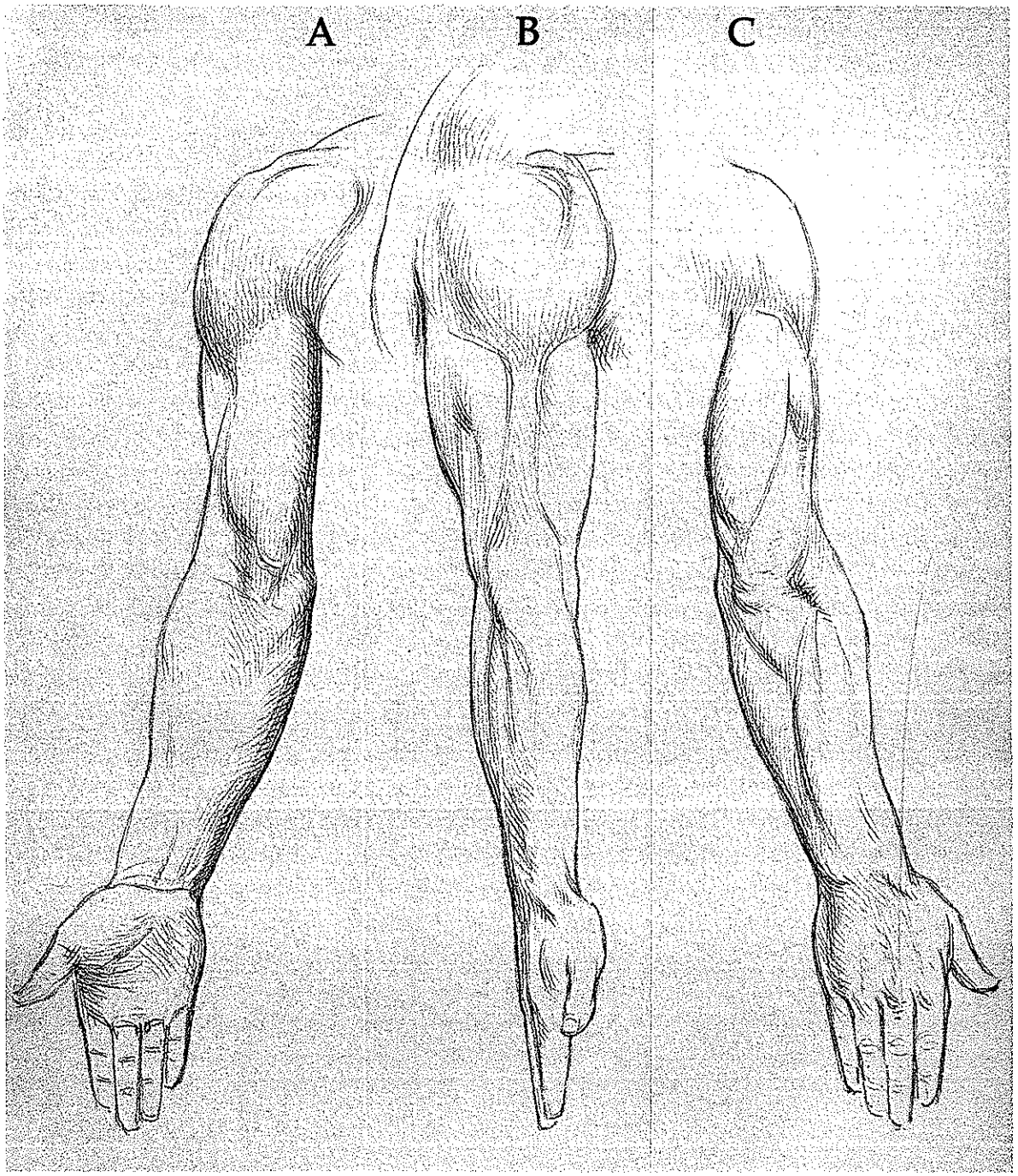

Figure 91: Masculine upper limb

A. Anterior view B. Lateral view C. Posterior view

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1. Anterior view

Figure 88, C and Figure 91, A

Profiles: The internal profile changes relatively less than the external; it always has its fixed point at the medial epicondyle. At the arm, the curvature increases more than it does in a feminine arm, especially in its upper part, because of the greater volume of the triceps. At the forearm, the upper inflection of the curve will be more pronounced than the lower one because the shape of this curve is determined by the augmentation of numerous muscular masses, while the lower portion is only due to the flexor carpi ulnaris and the amount of fat present.

At the lateral profile, the development of the deltoid exaggerates the top portion of the curve, which ends at the fixed imprint of the deltoid's insertion. The straight line of the arm is replaced by a curve determined by the size of the brachialis and triceps, whose lateral head surpasses brachialis a bit on the outside. At the forearm, the two inflections are accentuated, with the first subdivided in two. Thus, the three reliefs that emerge to create the shape of the forearm are caused, going from top to bottom, first by the muscles of brachioradialis and extensor carpi radialias longus appearing together as a mass, second by the extensor carpi radialis brevis, and third, by the muscles of the thumb. This final relief is always smaller than the two others.

Planes: The planes that fill in these profiles are influenced by muscular development, so it will suffice for me to list them (Figure 91, A). At the shoulder, the deltoid has its maximum projection in front, at the level of the head of the humerus. At the arm, the relief of the biceps is flanked by the two lateral flat planes of brachialis below it, and terminates obliquely at the bottom because of the way the muscle fibers insert onto the tendon. At the anterior crease of the elbow, the forms of the cubital fossa and the flexion folds persist without modification. But the external muscular mass, formed by brachioradialis united with extensor carpi radialis longus, increases considerably in volume. Together, these forms descend on the anterior part of the forearm. To the outside of this form, the distinct relief of extensor carpi radialis brevis appears, seen in profile. Within the cubital fossa, the cord formed by the inferior tendon of the biceps reveals itself, and further inside, beginning at the medial epicondyle, we see the isolated relief of pronator teres. At the forearm, a central longitudinal flat plane is bordered on the outside by brachioradialis and on the inside by the common mass of the flexors of the fingers, covered by the muscles originating from the medial epicondyle. It is depressed, at its upper part, by the oblique crease of the aponeurotic expansion of the biceps. At the wrist, nothing is changed in the tendinous projections, and the flexion folds naturally do not experience any modification. The hand only shows an augmentation of volume in its fleshy masses and its bony framework.

2. Posterior View
Figure 89, C and Figure 91, C

Between the profiles, which remain the same as those of the anterior side, we see the following planes on the posterior side.

Planes: At the arm, there is greater development of the triceps muscle, whose different portions appear distinctly. Above the olecranon, the long flat plane of the common tendon rises diagonally to the lateral side and is bordered by the projections of the various heads of the triceps: above and to the outside, the lateral head; inside, superimposed and very unequal, the powerful relief of the long head, and below, the medial head.

At the elbow, we have the fixed forms of the olecranon process, the fossa of the lateral epicondyle, and the groove that separates the olecranon from the medial epicondyle.

At the forearm, the fixed form of the ulnar groove is accentuated because of the development of the muscles that surround it. Above it is the triangular plane of the anconeus, and inside, the large projection of flexor digitorum, covered by flexor carpi ulnaris, which forms the entire inside edge of the forearm. On the outside, two elongated projections of unequal volume are found around the middle of the dorsal side and continue along the entire length of the forearm. The smaller one is caused by the extensor carpi ulnaris, the larger one by the extensor digitorum. The whole outside edge of the forearm is occupied by a succession of muscular reliefs of different volume. The greatest, and also the highest, borders the fossa of the lateral epicondyle from the outside and climbs up onto the arm; it is caused by extensor carpi radialis longus united with brachioradialis. The form of extensor carpi radialis brevis is more modest and situated below. Finally, the lowest, always moderate in volume, is caused by the plump forms of abductor policis longus and extensor policis brevis joined together.

The bony and tendinous reliefs of the wrist and the back of the hand do not change significantly; only the first dorsal interosseus increases in volume.

3. Lateral View

Figure 90, C and Figure 91, B

Profiles: In this respect, the changes that occur are very simple and can be summarized as follows: enhanced curves along the contours whose points of departure remain essentially the same. At the arm, the curve of the triceps only accentuates itself at the top, while the curve of the biceps is felt along its entire length. At the forearm, the profiles only increase in the upper half of the limb, in the region of the bellies of the muscles. At the wrist and the hand, there is no change.

Planes: The planes which fill in these profiles are more complex. At the shoulder, the deltoid's projection is more marked in front and ends at the fixed depression of the deltoid insertion. From here, at the middle of the upper arm, the flat plane of brachialis is surrounded by two grooves that separate it from the biceps in front, and from the triceps in back. Along the midline of the forearm, we see the superimposed reliefs of brachioradialis united with extensor carpi radialis longus, then extensor carpi radialis brevis, and finally, the extensors of the thumb. On either side of this median relief, one sees the muscular projections already described on the anterior and posterior sides.

C. Postures of Pronation and Supination

After having described the upper limb in the classic posture of supination, it is important to look for the morphological changes that occur in various degrees of pronation. Pronation is much more common than supination, which is always somewhat unnatural even though it is a quintessentially human gesture. Animals who have two mobile bones at the forearm, like the bear or the lion for example, maintain complete pronation in standing and walking posture. To catch or hold their prey, their front limbs are placed in semi-pronation, but never in complete supination. It is the same in the great apes, so similar to humans that we have classified them under the category of anthropoids. When one sees them walking with their two big arms dangling alongside their bodies, the backs of the wrist are turned forwards in absolute pronation. A certain number of men walk in this fashion. It might be interesting to look for differences that may exist in this regard between men and women.

When one allows the upper limb to fall naturally and without effort along the side of the body, the forearm always places itself in an attitude of pronation, the degree of which varies with individuals. Semi-pronation is practically the rule. But complete pronation is also observed sometimes, and here is its degree of frequency according to my records. In men, pronation was seen in 10 subjects out of 26, which is to say a bit less than half. While, to find 10 feminine subjects whose forearm falls naturally in pronation, we had to observe 55 of them. The proportion is therefore a bit less than one-fifth. This is a curious contrast between men and women.

The illustrations in Figure 92 show the upper limb in the successive postures of supination, semi-pronation, and pronation seen from the three principal views. The extreme postures of forced supination, which is only easy for women to assume, and forced pronation, easily achievable by both sexes, have been neglected.

To follow their progression, we must recall the mechanism of rotation of the upper limb on its axis. This rotation is a complex movement that does not remain confined only to the forearm, as one would be tempted to think, but in which the upper arm also plays a part. Thus, it is easy to show that, when the hand makes a rotation of three-quarters of a circle, the forearm turns in a half-circle and the upper arm in a quarter-circle. And these two movements

do not occur one after the other so as to add one to the other. Rather, they begin together and take place simultaneously.

The humeral rotation can be easily seen from the movement of the epicondyle and the olecranon, and one sees that in semi-pronation, these two points are displaced. As for the rotation of the forearm, it is easily measured by the displacement of the lower ends of the radius or ulna, and of the hand itself that is attached here. In the three illustrations of Figure 92: A, B, C, one notices that the total rotation is only a semicircle that is unequally shared by the two segments of the limb. If we add forced pronation, the rotation would reach three-quarters of a circle as mentioned above. If we also consider forced supination, which is common in women, we see that the rotation can reach a complete circle for some individuals.

When the upper limb is extended, rotation is always a compound movement shared between the upper arm and the forearm. If we want to know the part that comes from the forearm alone, it suffices to immobilize the humerus, by the flexion of the elbow to a right angle, for example, and one will notice that it cannot exceed a semi-circle (Figure 92, D).

The changes in the shapes of the limb as a whole during pronation are the following: the axis of the forearm, turned to the outside in supination, returns in pronation to align itself with the axis of the upper arm. Thus, in pronation, the axes of the different segments of the limb follow the same straight line.

We know that, in supination, there is a difference between the forms of the forearm and those of the upper arm, both of which are oval in shape, but with different orientations. The widest part of the upper arm is oriented on a horizontal plane from front to back, while the widest part of the forearm is aligned transversally. Therefore, on the upper limb seen from the front, the forearm is wider than the upper arm. However, when the arm is seen from the side it is the opposite: the upper arm is wider than the forearm.

These oppositions disappear with the movement of rotation. In pronation, the shape of the whole upper limb becomes more equal and more rounded when viewed from the front; the wrist is narrower than it appears in supination, a fact specifically recorded in the notebooks of Leonardo da Vinci.

Regarding the secondary shapes, it would be a tedious undertaking to describe them in detail. It will suffice to add several general remarks that will facilitate an understanding of the illustrations.

I will not repeat the mechanisms of movement of the skeleton, which the visible parts of the bones always permit one to assess.

To understand the transformations of the muscular shapes, one will note that all the evident muscles of the upper limb are elongated in shape and positioned around the skeleton in a manner parallel to it. Also, their insertions, made on either end, are often very far apart from one another. Since the rotation of the skeleton increases as one moves away from the shoulder and towards the hand, it follows that the muscles, drawn along in this movement, will see their peripheral ends displaced more as they are wound around the bones. For the large muscles like the biceps and the triceps, this is easy to see. This twisting is even observed on the lower part of the deltoid. In the muscles of the forearm, it is also quite evident. And for guidance in the drawing of these often complex forms, I generally advise the student to focus on an anatomical form that is arranged along the length of the limb, like the long series of

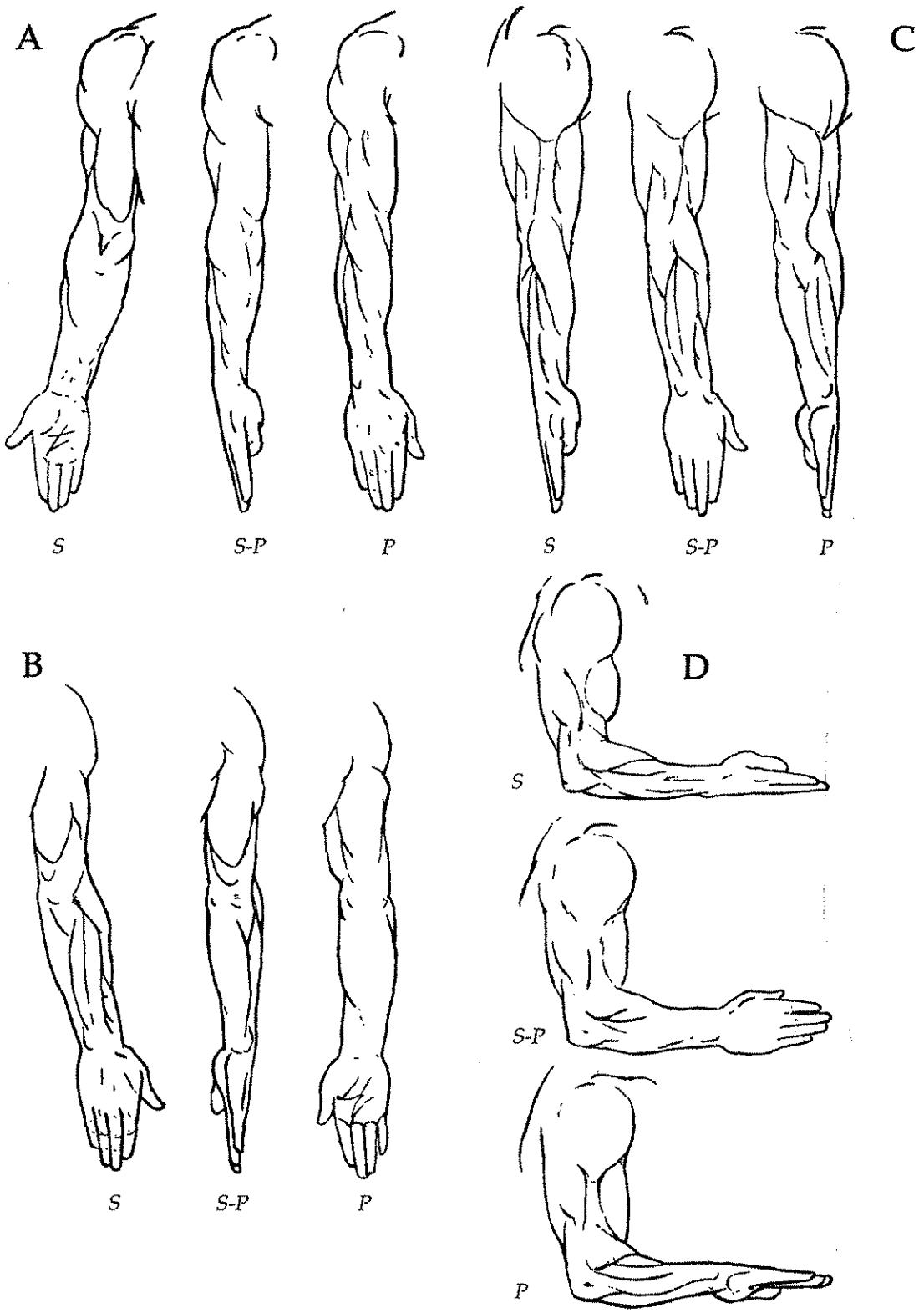

Figure 92: Masculine upper limb in postures of supination (S), pronation (P), semi-pronation (S-P), extension, and flexion

A. Anterior view

B. Posterior view

C. Lateral view

D. Flexion of the elbow with the forearm in supination, semi-pronation, and pronation

muscular projections which form the outer edge of the forearm in supination: brachioradialis and extensor carpi radialis longus, extensor carpi radialis brevis, extensors of the thumb; or even the ulnar groove whose termination at the styloid process of the ulna is always easy to recognize, or on some other detail that is convenient. In recognizing the changes that occur along the specially observed part, it will always be easy to relate the changes observed in the neighboring parts.

D. POSTURES OF FLEXION

Figure 92, D

What happens to the forms of the upper limb in the flexion of the forearm onto the arm? The anterior crease of the elbow transforms itself into a deep fold that hides the details seen in extension, while in back, new forms reveal themselves. The projection of the olecranon process accentuates itself to the point of representing the apex of an angle whose degree varies: obtuse, right, or acute, according to the degree of flexion. It resumes its position at the middle of the width of the elbow. One remembers that, in extension, the olecranon is placed much closer to the internal side than the external side. On each side of it, at a nearly equal distance, are the projections of the two tuberosities of the distal end of the humerus: the medial epicondyle on the inside, which has not changed its place, and the lateral epicondyle, revealed by the displacement of the external muscles of the forearm: brachioradialis and extensor carpi radialis longus.

In terms of the morphological changes that result from flexion of the elbow accompanied by rotation of the forearm to various degrees, a comparison of the illustrations in Figure 92: A, B, and C between each other, and those of D from the same plate, is very instructive.

One sees here that, in the illustrations representing flexion, the biceps has changed shape with the rotation of the forearm. This is because the biceps, while being a flexor, is also a supinator, and it only accomplishes the flexion of the forearm on the arm when its action of supination is achieved.

On the illustration D-S with the forearm in supination, the biceps has the spherical shape of contraction. On the two other illustrations that follow, the biceps elongates as it is relaxed, and the flexion is maintained by another flexor muscle, brachialis.

The comparison of Figures D with Figures C in the same plate clearly shows the part that the upper arm plays in the movement of rotation during the extension of the limb. It is easy to see that the twisting of the forearm muscles around the skeleton is much more pronounced in D than in C to achieve a similar position of the hand. This is because the rotation of 180° is achieved by the forearm alone; the immobilized humerus cannot intervene for its usual share, which is 90.°

It even happens that, in athletes who have very large muscles, the twisting that is required for complete pronation can only be achieved with effort because of the difficulty experienced in twisting voluminous muscles. But for women, whose muscles are always of more moderate volume, these movements are executed with the greatest of ease.

E. The Hand and Fingers

Now, several words on the hand and the fingers, which inevitably have been somewhat neglected in the preceding general study.

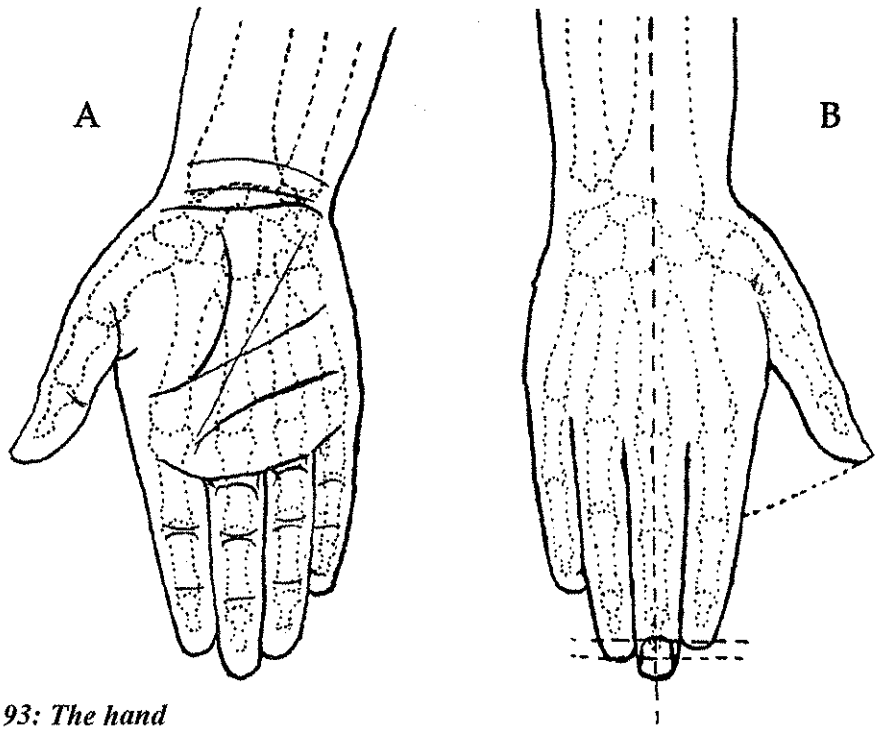

Figure 93: The hand
A. Folds of the wrist, the hand, and the fingers.
B. Relative lengths of the fingers according to the formula of artists.

I will not return to the palm of the hand and the dorsal surface, which have been sufficiently described above. From the wrist, the hand has three sides: a radial side, an ulnar side, and a distal side that attaches to the fingers.

The ulnar side is rounded and is reduced in volume as it approaches the fingers. The radial side, in its proximal part, supports the thumb, while the distal portion corresponds to the metacarpophalangeal joint of the index finger. The first metacarpal, connecting to the thumb, is situated on an anterior plane to that of the other metacarpals; furthermore, it is oriented obliquely downward and to the outside. Its anterior side is turned toward the median axis of the hand. An extensive commissure joins the thumb to the base of the index finger and is formed by a fold of skin whose edge is thin and concave toward the outside.

At the lower edge of the hand, on the palmar surface, all the fingers are connected by similar cutaneous folds at their base. The most inferior plane of the commissure also has a distinctive cutaneous fold, joining the thumb with the palm. In effect, these interdigital commissures are cut diagonally through the thickness of the hand in such a way that, from the cutaneous palmar fold corresponding to the middle of the phalange, they climb up on an inclined plane towards the back of the hand until the metacarpophalangeal joint.

The distal edge of the palm is convex. It curves very slightly towards the index finger and much more towards the small finger.

Fingers

As a result of the special arrangement I have described, all the fingers, with the exception of the thumb, appear longer when seen from their dorsal side than from the palmar side. On the dorsal side, in effect, the fingers begin at the metacarpophalangeal joints. On the palmar side, the palm of the hand, which continues until around the middle of the proximal phalanges, diminishes the length of the fingers by the same amount (Figure 93).

Each finger is composed of three segments that bear the names of the bones of their skeleton: proximal, middle, and distal phalanges. The thumb has only two segments: the proximal and distal phalanges.

Irregularly cylindrical, the fingers have four distinct planes: one anterior or palmar, one posterior or dorsal, and two lateral. The backs of the fingers are rounded and marked at the joints by transversal folds that make an ellipse at the junction of the proximal and middle phalanges, and are more irregular and superficial at the next articulation. On the fingers of women who are slightly plump, these cutaneous folds are replaced by dimples, which may also exist at the metacarpophalangeal joints in the same circumstances (Figure 96: A, B).

The fingers end with the nail, located on the dorsal side. The palmar side is divided into three parts by the flexion folds (Figure 96, C).

The first fold separates the fingers from the palm of the hand, and disappears on the sides with the interdigital commissures. It may be doubled for the two fingers in the middle of the hand, the middle and ring fingers, which seem rather close together here. Of the three segments, the middle is the shortest. The fold that borders it proximally is generally doubled, while that on the distal side is single. A dense and elastic tissue lines the skin of the palm and is especially abundant on the last phalanges, where it forms the fingertips. This surface has longitudinal creases running through it that disappear when the phalanges are flexed onto one another, as a result of the swelling from this movement.

The lateral sides of the fingers are simpler; they show the termination of the folds from the palmar and dorsal sides. I will not dwell on the differences in volume of the fingers. Regarding their length, there is the question of the predominance of the ring finger or the index, which I will try to resolve.

The middle finger is the longest of all the fingers. On either side of it, we find the index and the ring finger. Of these two fingers, which is the longest? In other words, which is the one whose end most approaches the middle finger? The opinions are divided. To settle the dispute, I have taken care, in all the subjects that I have measured, to trace the contour of the hand placed flat on a sheet of paper, and also the foot in similar conditions, because an analogous question poses itself for the length of the toes. I will discuss that at the appropriate time.

To trace the contour of the hand, certain precautions are necessary. The hand needs to be applied very flat on the surface of the paper, with the fingers extended and held together. The pencil, sharpened to a long point, needs to be held quite perpendicular to this surface. It is also necessary that the middle finger be placed exactly in line with its metacarpal (Figure 93, B). Now, to obtain this result, it is very rare that a slight correction does not have to be made on a hand posed naturally, because there is almost always a general inclination of all the fingers towards the ulnar side of the hand. This inclination is usually slight, but sometimes it is accentuated and tends toward ulnar deviation, a symptom of arthritis.

One can easily understand the necessity of this last precaution. An inclination towards the ulnar side produces the apparent elongation of the ring finger, and at the same time shortens the apparent length of the index in relation to

the middle finger. Often, a hand that at first glance seems to have the ring finger longer than the index will show the reverse relationship once this correction has been made. Hence, I believe, the generally accepted opinion of the predominance of the ring finger over the index, which has led to the formula taught in ateliers regarding the relative lengths of the fingers. This is as follows (Figure 93): on a hand seen from the back with the fingers held together and extended, the tip of the index finger arrives at the base of the nail of the middle finger, while the end of the ring finger continues until the middle of this nail. The small finger reaches the last articulation of the ring finger. The thumb, held alongside the index finger, continues until the joint between the proximal and middle phalanges of the index finger (Figure 93).

From examining my tracings, I have found that this formula is only true in 37 of 100 cases. In a nearly equal number, this formula is reversed and the index exceeds the ring finger, while in the rest of the cases, the two fingers are equal. With respect to the relative lengths of the fingers, there is no difference between men and women, as reflected in the following table:

	On 100 women	**On 30 men**
Index finger longest	37%	36.6%
Equality between index and ring fingers	25%	26.8%
Ring finger longest	38%	36.6%

The central axis of the hand passes through the third metacarpal, which attaches to the middle finger.

The fingers diminish in volume as they approach the fingertip. They are straight, and hardly bulge at the joints. Gnarled fingers, even in men, are never an indication of strength; they are caused by gout or arthritis. The absolute straightness of the fingers is rare. Very often, especially in women, they curve in one direction or the other (*clinodactyly*). Any of the fingers can have this bend, often in opposite directions from one other. However, it is most often seen in the ring finger and the little finger.

In the anterior-posterior direction, which is to say in the direction of flexion and extension, one also observes in women, a dorsal curvature of all of the fingers due to the natural laxity of the ligaments. This is only an exaggeration of the normal state; the distal phalanx, even in men, is slightly tilted backwards. An incomplete extension of the phalanges, limited to the small finger and also sometimes including the ring finger (*camptodactyly*), is a different sort of deformation. This is a manifestation of arthritis that is observed quite often in women.

F. Movements

The movements of the different joints of the upper limb compound one another and complement the movement of its final segment, the hand, whose actions, play, and gestures are infinitely varied.

In women, these movements may have an even greater range of extension in different directions. For example, dancers can achieve surprising and unexpected effects with the gestures of their arms.

Without going into detail about the different joints of the upper limb, let me say a word about the characteristics they present in women from the point of view of movements, and which always depend upon the natural laxity of the ligaments, the moderate volume of muscle, and the delicacy of the skeleton.

1. Movement of Rotation

I have already mentioned the rotation of the arm above, so I will only mention the differences in this respect between men and women. When the elbow is flexed at a right angle, the movements of pronation and supination, which involve the two bones of the forearm,[45] have a range of motion of a half-circle. This does not vary between men and women. But when the limb is extended alongside the body, the rotation of the forearm adds to the rotation of the humerus, limited only by the flexibility of the ligaments and muscles. In men, the hand makes a rotation of ¾ of a circle. The successive positions taken by the hand during this twisting movement are supination, pronation, and forced pronation.

In women, the rotation of the limb is greater; a large number of subjects can make a complete turn of the hand. From the posture of supination, which places the palm directly forwards, many women can easily pass to forced supination, in which the palm is directed outwards exactly like in forced pronation though with the hand in the opposite orientation (Figure 94, A).

2. Flexion and Extension of the Elbow

The flexion of the elbow is limited by the meeting of the anterior surfaces of the arm and the forearm and hardly changes between men and women. It is not the same for extension, which is sometimes barely achieved by men, and always exceeded by women. This exaggerated extension is caused by a greater degree of laxity in the ligaments and is also frequently observed in childhood for the same reasons.

Figure 94 (right): Upper limb; rotation and hyperextension

A. Forced supination in a female arm, a movement particular to women.
B. Supination, hyperextension of the elbow
C. Semi-pronation
D. Pronation
E. Forced pronation
F. Hyperextension of the elbow in a movement of supplication
G, H. Hyperextension of the elbow in a boxing instructor
I. The same as above, in a weightlifter

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[45] See Dr. Richer's *Artistic Anatomy*, Hale translation, p. 114.

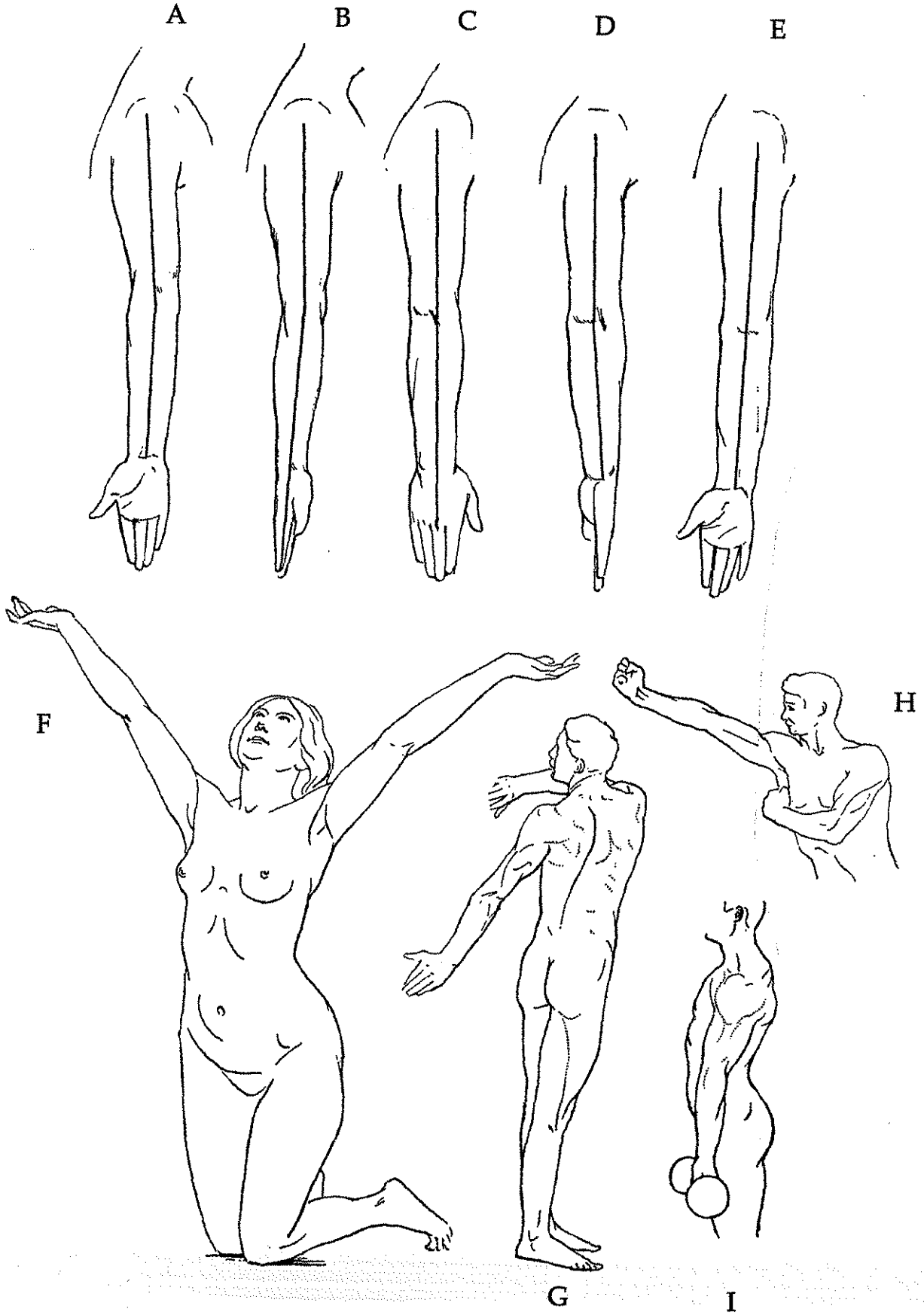

Figure 94: Upper limb; rotation and hyperextension

In the full extension of the elbow, the backwards deviation of the axis of the forearm is so frequent in women, regardless of their muscular development, that it should be considered the rule (Figure 94, F). This hyperextension of the elbow gives a very particular accent to certain feminine gestures, which artists have used to their advantage on many occasions. It is true that this hyperextension is also observed in men, although much less often, and is hardly ever seen except on muscular individuals: athletes, weight lifters, boxers, etc. (Figure 94: G, H, I) It seems that there is a contradiction here, but the same phenomenon can be explained in both cases by the same cause: a particular laxity of the ligaments of the elbow joint. This is a natural laxity in women and is acquired by athletes as a result of the repetition of forceful movements of extension. If the arm is extended and the hand rests on a stable surface, one can make a curious movement of circumduction of the elbow due to a combination of rotation and hyperextension (Figure 95).

3. Movement of the Wrist

Flexion of the wrist is stopped by the limit of flexibility of the extensor muscles of the fingers, whose tendons wrap over the dorsal surface of the wrist and fingers. Complete flexion of the fingers lengthens the course of these tendons, and as a consequence, stops the flexion of the wrist sooner. The range of flexion of the wrist increases when the fingers are extended. In flexion, the back of the wrist becomes rounded. In men, the degree of flexion does not exceed a right angle. In women, the degree of flexion is greater; when it is slightly forced, it is not uncommon to see the thumb arrive in contact with the anterior surface of the forearm.

In extension, the limit of movement is due to a similar cause as that which stops the flexion of the wrist. Once again, it is the muscular flexibility that, being unable to exceed a certain degree, prevents the movement from continuing further. In this case, it is the flexors of the fingers that determine the range of extension of the wrist. The flexion of the fingers has the effect of elongating the course of the tendons of these muscles, thereby decreasing the degree of extension of the wrist. Once again, the degree of extension of the wrist becomes greater when the fingers are extended.

The limit of muscular flexibility varies with the length of the muscle fibers and also with exercise. Therefore, it is clear that these movements of flexion and extension of the wrist, which are not prevented by any fixed position of the joint, are extremely variable in different subjects, although generally more pronounced in women than in men. In terms of extension, the angle formed by the back of the hand and the forearm is always more or less obtuse in men, while it sometimes reaches a right angle in women.

Lateral movements of the wrist are always much more pronounced toward the ulnar side than the radial side. Their total range of motion is barely a right angle.

Figure 95 (right): Circumduction of the elbow when the arm is extended and the hand held on a stable plane

A. Arm in semi-pronation

B. The elbow makes a movement of forward rotation which brings the anterior elbow forwards, as in forced supination.

C. Rotation of the elbow in the opposite direction, bringing the olecranon to the outside, as in complete pronation.

D, E, F. The same movements of the elbow with the limb in the posture of supination.

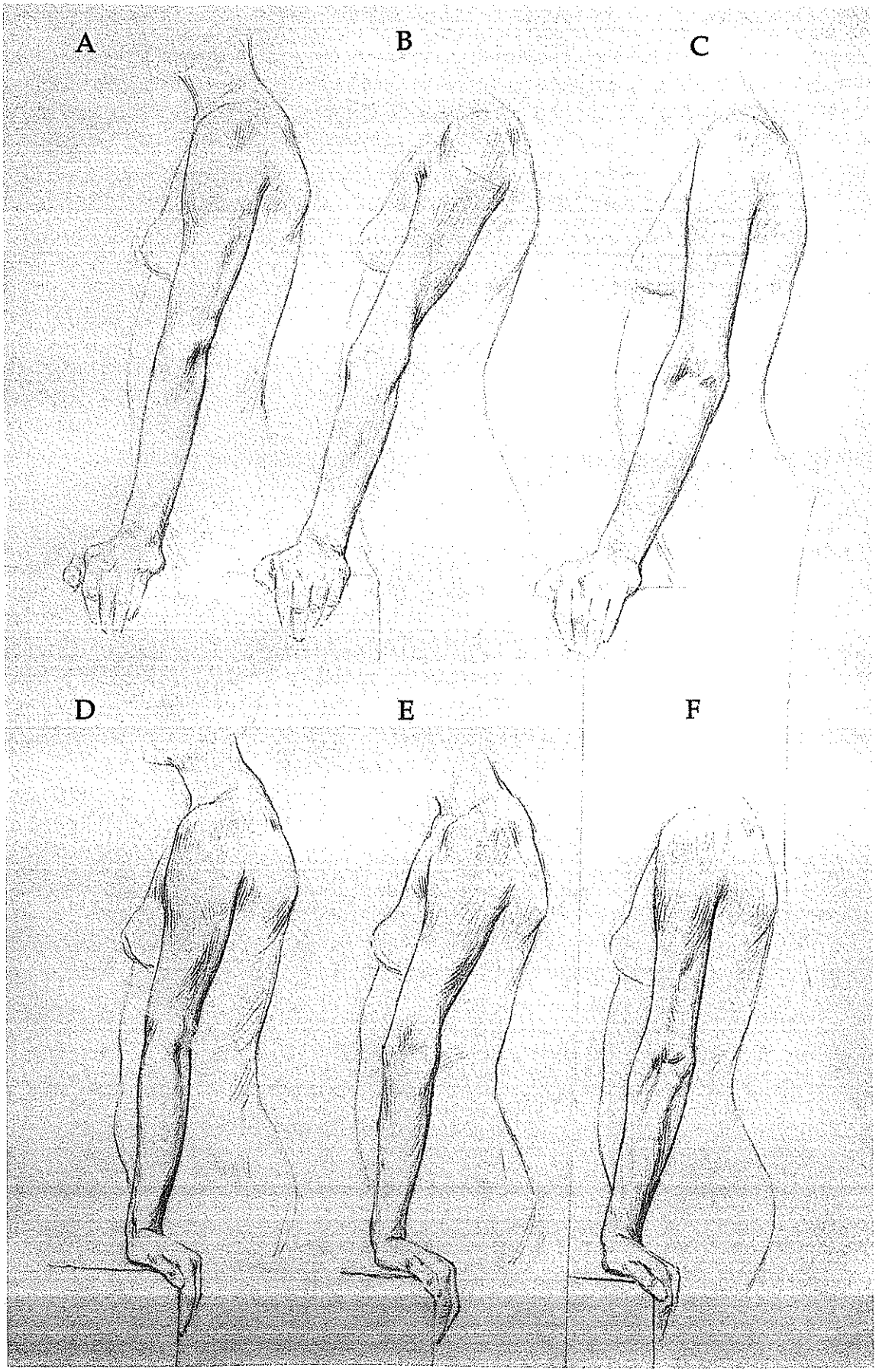

Figure 95: Circumduction of the elbow when the arm is extended and the hand held on a stable plane

4. Oppositional Movements

The thumb enjoys a remarkable independence in its movement due to the mode of articulation of the first metacarpal with the trapezium.[46] As a result, the thumb, endowed with true movements of circumduction, can bring itself in front of the other fingers and over to the ulnar side of the hand. But a little-known fact is that a similar articular disposition exists between the last two metacarpals, especially the fifth, and the lower surface of the hamate. This is the cause of the movements of the last two fingers, and the small finger in particular, which recalls the movement of opposition of the thumb (Figure 95, H). We can see that when the first metacarpal makes the movement of opposition, the fifth advances to meet it, and so the palm of the hand narrows while the back of the hand becomes rounded.

5. Movements of the fingers: Closed Fist

The metacarpophalangeal joints allow the fingers to move in all directions. Thus, they can extend, flex, and move away from or towards one another. Their extension is only limited by the flexibility of their ligaments and the flexor muscles. Typically, in men, the fingers, in extension, bring themselves backwards to the point of describing an obtuse angle with the back of the hand, which is variable among individuals. In many women, this angle can easily reach a right angle.

The joints between the phalanges have the shape of pulleys and move as hinges in a single plane, with only two possible movements in opposite directions: flexion and extension.

The closing of the fist consists essentially of flexion brought to the extreme, with the fingers inside the palm of the hand. But the position of the thumb is variable. It may be placed on the outside of the index finger without any movement of opposition (Figure 96: D, E, F). This is how it appears in the artwork of primitive civilizations when characters are represented with a closed fist; the Egyptians, Assyrians, etc. This is also the way that women often make a fist.

The thumb may also be opposed and placed in front of the flexed fingers (Figure 96, I), as is customary for men. When the thumb is opposed, we also often see opposition of the two last metacarpals. Thus, the fist is narrower; its overall shape is more rounded and its back is also more convex (Figure 96, G). In this respect, a curious and striking difference exists between the closed fists of men and of women.

Figure 96 (right): Several drawings relating to the hand

Feminine hand:

A, B. Dorsal view. Dimples are present at various joints.

C. Palm of the hand with creases showing the cursive M, upside-down in this view. The two legs of the M are made by the crease of the thumb and the crease of the fingers, while the central V is made by the two secondary creases.

D, E, F. Closed fist without opposition of the thumb, as usually seen in women.

Masculine hand:

G. Closed fist with opposition of the thumb and the last metacarpals

H. Simultaneous opposition of the thumb and the last two fingers

I. Closed fist with opposition of the thumb only

J. Movement of opposition of the thumb

K. Fist without opposition of the thumb, in the manner of of the feminine hand seen in F.

[46] See Dr. Richer's *Artistic Anatomy*, Hale translation, Plate 21, Figures 3 and 4, and Plate 22. p. 37-39 and 159-160

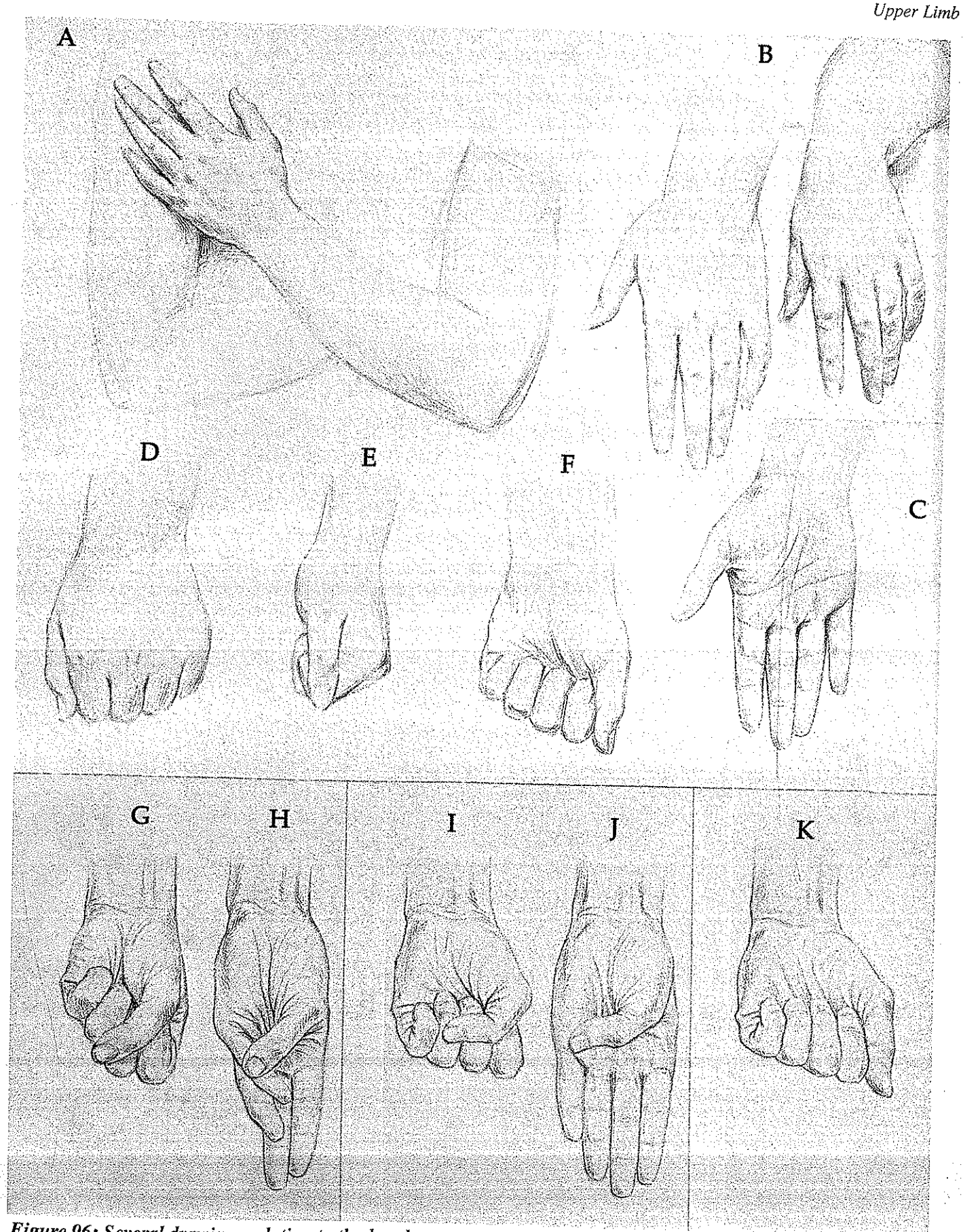

Figure 96: Several drawings relating to the hand

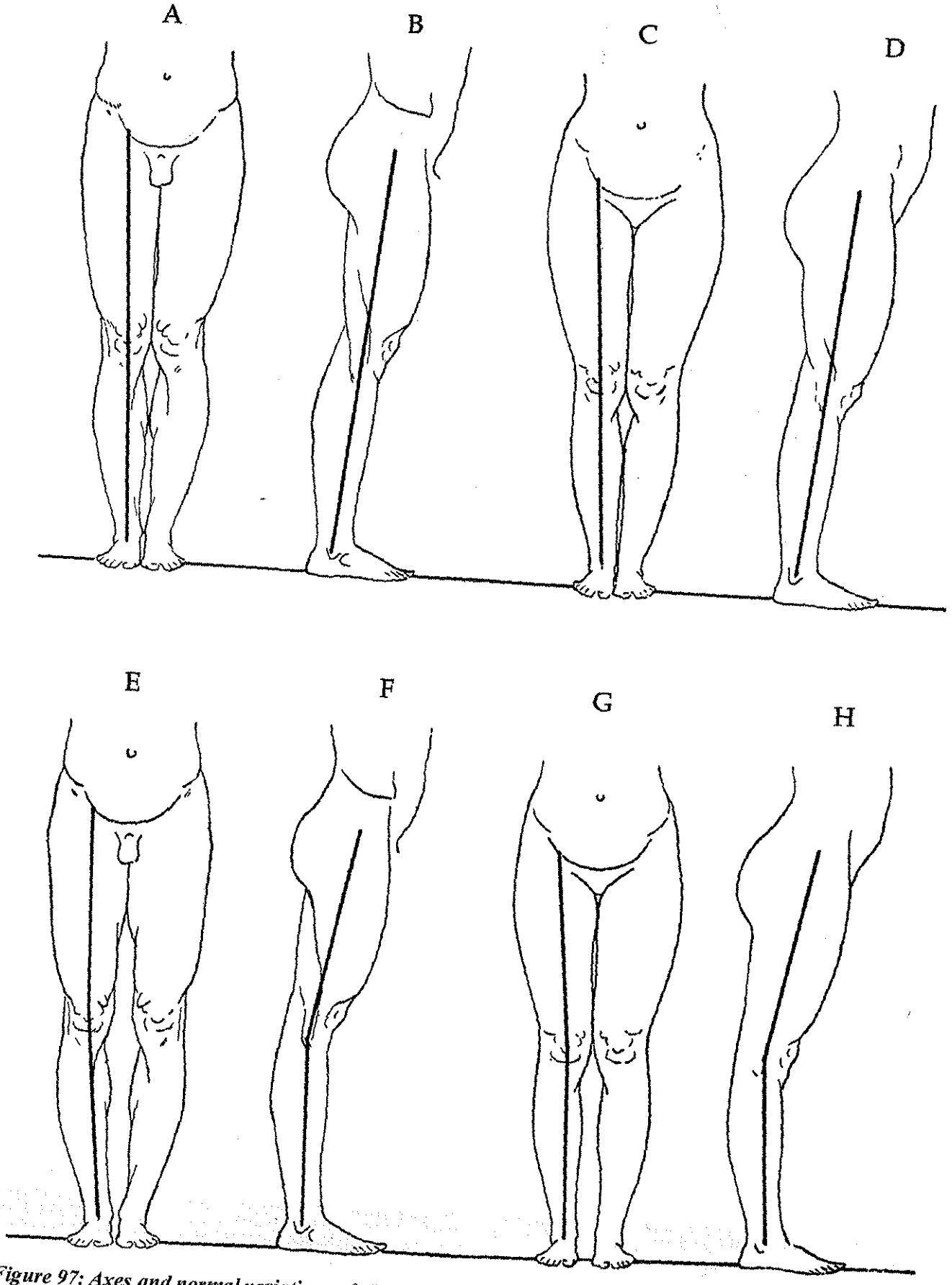

Figure 97: Axes and normal variations of plumb lines in the leg

VII. Lower Limb

In the description that follows, I will adopt the same method as I used for the upper limb. Leaving aside a detailed description of its regions, for which I refer the reader to my *Anatomie Artistique* where all of these questions of regional morphology are treated in detail, I will consider the lower limb in its ensemble; successively studying the contours and the planes contained between them from the principal views. By the determination of fixed and variable forms, I will try to establish a link between different individual conformations, and in particular, between the feminine and masculine conformations.

A. Axis of the Lower Limb

Let us begin by defining the axis of the lower limb. We have seen that the axis of the upper limb is not represented by a single straight line; the forearm always deviates outward to a greater or lesser degree. It is not the same in the lower limb, where the normal conformation is represented by an axis that does follow a single straight line from the root of the limb to the foot. The axis of the thigh does not follow the bone of the femur, which is placed obliquely through the middle of the soft tissues. From the middle of the lower leg, the axis connects to the center of the ball of the femur. The middle of the crease of the groin corresponds to this point on the surface of the nude.

From the front view (Figure 97: A, C), the axis of the lower limb is represented by a straight line that passes from the middle of the crease of the groin, through the middle of the patella, and then through middle of the instep. On the profile (Figure 97: B, D), the same axis is represented by a line passing from the center of the great trochanter, through the middle of the knee, and through the middle of the lateral malleolus.

This absolute straightness of the lower limb is not exceptionally rare. In beautiful models, it is found as much in muscular men as in women. I know of numerous examples. In this case, when the lower limb is straight and the feet are held together, the lower limbs touch each other at the top of the thighs, the knees, the calves, and the medial malleolus. But, in this respect, variations exist in nature that cannot be regarded as flaws, which I must mention here.

In beautiful models that are rather muscular, and in nearly all professional athletes, I have observed that the knee is carried somewhat outside of the line that joins the middle of the crease of the groin and the middle of the instep. When these subjects stand in upright posture and bring their feet together so that they touch along the whole inside edge, the knees are separated by a space that may be great or small (Figure 97, E). To examine the posture of the knee, the feet must be held together from the heel to the large toe as a necessary precaution. This permits comparison between different subjects from an identical starting point for all, and it detects a conformation that would be hidden in a slightly different position. In standing posture, when the heels are touching, the direction of the toes naturally inclines more or less to the outside. Now, in a model who seems to have a complete straightness in the

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Figure 97 (left): Axes and normal variations of plumb lines in the leg
In men:

- *Absolute straightness of the axes of the front (A), and profile (B)*
- *Knees carried to the outside (E)*
- *Hyperextension of the knee (F)*

In women,

- *Straightness from the front (C), and the profile (D)*
- *Knees carried to the inside (G)*
- *Hyperextension of the knee (H)*

lower limb because the two knees touch each other slightly in this position, one will often see things change when one asks them to bring the inside edges of the toes together. The knees will spread themselves more or less and will move to the outside. It is also important to ensure that the knees are fully extended, as the slightest degree of flexion favors their coming together.

Among those subjects who have the knees spread apart, we must distinguish those who also have an inward curvature of the distal tibia from those in whom the tibia keeps a perfect straightness. In the first case, one could assume a mild case of rickets. But in the others, given its frequency in beautiful models and its near constant coexistence with a powerful development of muscle, it is impossible to see this widening of the knees as anything other than one of the attributes of an athletic physique and not, in any case, an indication of abnormality. Moreover, the Greeks, who knew of the most beautiful human forms, gave this conformation to most of their statues of athletes. On the Doryphoros of Polykleitos, the Diadumenos in Madrid, the Borghese Warrior, and numerous others, a line that joins the middle of the groin with the middle of the instep on the standing leg passes noticeably inside the middle of the articulation of the knee. It is the same on the Antinous of Belvedere (Figure 98, E).

This outward inclination of the knee is accentuated in hipped posture, so it is easy to see in subjects who present it in standing posture (Figure 98: H, G). It results in a kind of curvature along the entire standing limb, which seems to heighten the aplomb of the whole figure. I recall that artists of Antiquity often reproduced this sort of curvature. Artists of the Renaissance also represented it and even made it a kind of attribute of the *contraposto* (Figure 98, F). They often combine this position of the knee with hyperextension, which I will soon discuss.

One may also observe the opposite conformation, which is to say, an inward inclination of the knees (Figure 98, A). In this case, when the knees touch each other, the feet spread themselves apart and cannot come together without some overlapping of one knee over the other, provided that the degree of this conformation is not too extreme. This is the *genu varum* of pathologists, a common symptom of rickets. One rarely observes the knee inclined inwards in men, even to a slight degree. In any case, it is seldom encountered in well-developed models, and never in the most beautiful subjects. There is therefore no reason to consider this type of conformation as a model for artists to imitate.

Figure 98 (right): Several examples of varying plumb lines of the lower limb in art and nature
Hyperextension of the knee:

A. Drawing by Signorelli
B. Perseus by Cellini
C. In a young girl, 14 years of age
D. In a young man

Knee carried to the outside:

E. Antinuous of Belvedere, Greek statue
F. Drawing by Leonardo da Vinci
G. In a young, muscular man
H. In an athlete

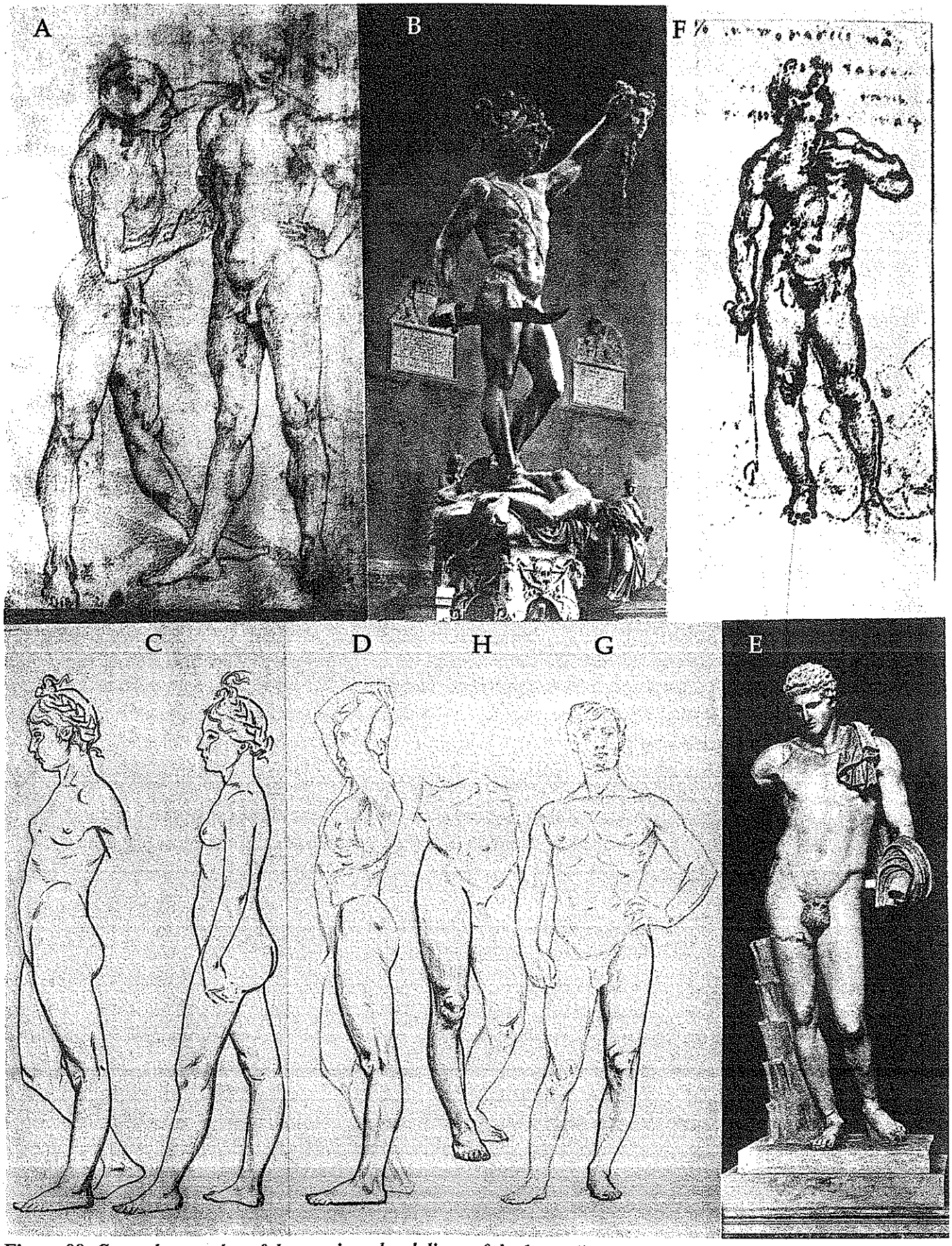

Figure 98: Several examples of the varying plumb lines of the lower limb in art and nature

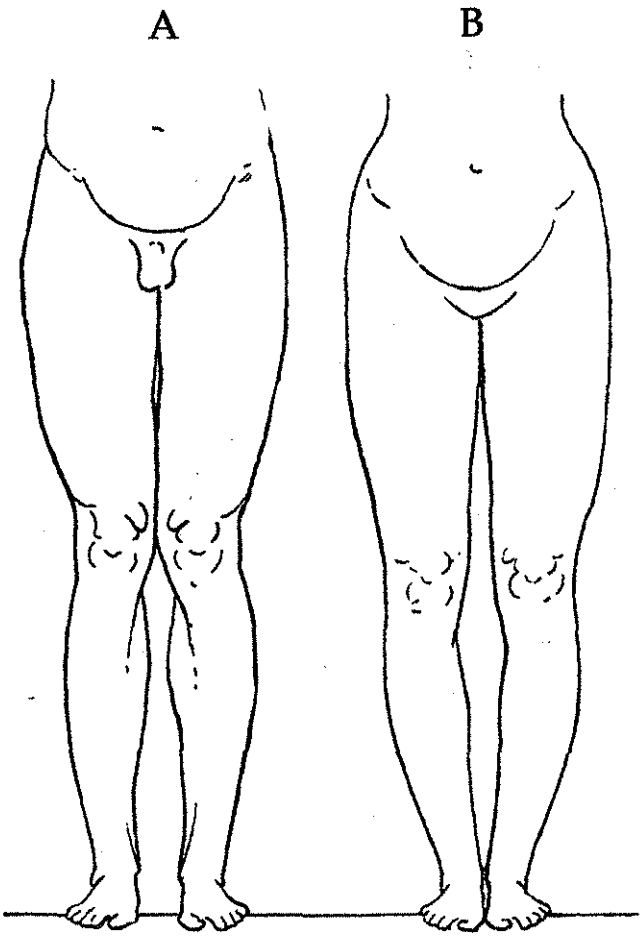

Figure 99: Unusual plumb lines in the leg; see also Figure 97
A. Knee inclined inwards in a man *B. Knee inclined outwards in a woman*

In women, as in men, one observes the absolute straightness of the lower limb in very beautiful models (Figure 97, C). And in this case, the extended lower limbs touch at the top of the thighs, the knees, the calves, the ankles, and the entire inside edge of the foot.

Also, in men and women alike, two variations exist depending on whether the knee is carried to the inside or the outside, but with an inverse proportion and a completely different significance.

It is not rare to see the knee carried to the outside, and it is often accompanied by a curvature of the distal tibia with a marked prominence of the medial malleolus (Figure 99, B). We will see that, in women, one of the conditions of good conformation is a moderate projection of this malleolus. Other times, the tibia keeps its straightness, as it does in men. But in this case, the outward movement of the knee does not accompany a developed musculature, as it does in athletes. And in women, this form is not justified in any way. It is often accompanied by an unpleasant gap between the whole length of the thighs, which is the result of a substantial width of the pelvis combined with a paucity of muscle.

Examples of knees carried more or less to the inside are much more common in women, and they occur in the most beautiful models regardless of their age, their size, or width of their pelvis (Figure 97, G). This form is so

common that some authors have wanted to see it as a consequence of one of the principal attributes of the feminine sex: the greater width of the hips spreads the upper ends of the femurs wider apart and brings their lower ends inwards to compensate. However, my experience does not justify this interpretation. I have sometimes found the coexistence of inward knees with a relatively narrow pelvis, while outward knees, as I have mentioned, seem to often accompany a greater width of the pelvis.

While the cause of the inward inclination of the knees is difficult to specify because of the complexity of the elements that enter into this particular conformation, the important fact to remember is that it is frequently found in the most solidly and well-built women, in those whose limbs have the most regular profiles. In these subjects, the lower limbs touch each other at the roots of the thighs and the knees only; the calves, the ankles and the feet spread themselves apart slightly. Indeed, this form is generally not pronounced and, in a slight degree, it can go completely unnoticed. It sometimes happens that the feet come to touch one another following the compression of the internal sides of the knees against each other, because the fat that generally surrounds this area is easily depressed.

In the present state of our knowledge, which is still quite incomplete on the conditions of the best conformations, I will propose the following interim solution for artists: the absolute straightness of the lower limb exists in both sexes. To comply with this is perhaps the wisest choice, but there is no need to consider it as a fault if the knee is slightly to the outside in athletes, or slightly inward in women.

B. Lower Limb of a Young Girl

Figures 100 A, 101, 102 A, 104 A, and 106 A

The relative narrowness of a pelvis that has not yet achieved its complete development; a muscular system that is satisfactory without being exaggerated; fat deposits that are clearly marked without being too pronounced; a young, firm, and elastic skin, lined with a dense and resistant cellular tissue that simplifies the contours and planes; these are the multiple conditions that make up the morphological type chosen to serve as the basis for this description. On her, we can easily distinguish the fixed forms of either bony or cutaneous origin that do not change regardless of the level of muscular development, as well as the variable forms caused by fat or muscle, which can displace one another and undergo significant changes in volume.

The following are fixed forms:

Skin folds:

- At the pelvis: on the side, the iliac line; in front, the crease of the groin and the crease of the thigh; in back, the gluteal cleft and the gluteal fold
- the flexion fold at the back of the knee

Bony forms:

- Anterior superior iliac spine
- Great trochanter
- Patella
- Anterior tubercle of the tibia
- Head of the fibula
- The entire bony framework of the knee, which is almost subcutaneous
- The medial surface of the tibia, which is subcutaneous
- The two malleoli
- The heel
- The top, or dorsal surface, of the foot

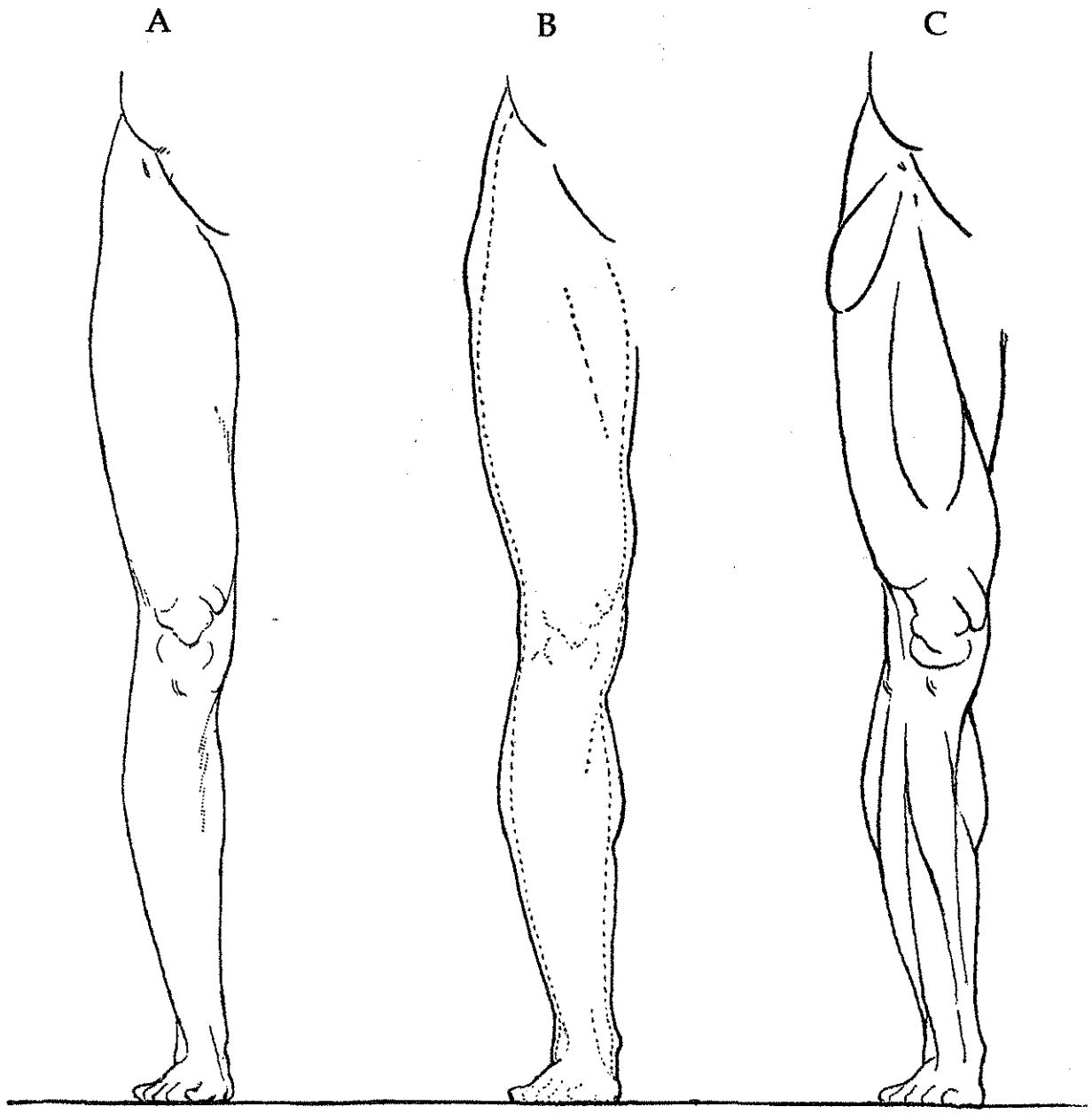

Figure 100: Anterior view

A. Lower limb of a young girl
B. Superimposition of figures A and C
C. Lower limb of a muscular man

1. Anterior View
Figure 100, A

Profiles: The internal profile begins at the crease of the thigh. In its first well-defined curve it includes the mass of the adductors, covered by a rather abundant layer of fat in this subject, and followed by another more low-slung curve corresponding to the vastus medialis. At the knee, the profile continues as a new curve that embraces its entire inner portion, and then is supported on the tibia by the adipose tissue located there. At the lower leg, a long curve clearly begins below the knee and descends without projection until it flattens itself along the lower part of the limb. Then, it rises slightly to form the projection of the medial malleolus, which is rather small in this case.

The outside profile begins below the iliac line as rather subtle curve leading to the great trochanter. Below the great trochanter, it swells to include the subtrochanteric fat deposit, specific to the feminine sex. It then continues with a lower curve corresponding to the vastus lateralis, which leads to the knee. Here, the contour almost follows a straight line, in contrast with the strong curve of the inside profile of the knee. At the lower leg, a single long curve inscribes the entire length of the outside contour, analogous to that of the internal profile. However, it differs in that it begins much higher, in an imperceptible manner around the middle of the knee. It also ends more abruptly than on the inside, above the lateral malleolus.

Planes: Because of the reduced muscle development in the thigh, the planes that fill in these profiles make a uniformly rounded surface that is slightly depressed a bit above the knee and is crossed obliquely by a superficial flat plane that follows the trajectory of the sartorious.

In a knee that presents the feminine characteristics without exaggeration, we first see a small patella surrounded by four reliefs arranged symmetrically around it: two above and two below (Figure 103: A, C, E, F, and Figure 105: A, E, F). Of these four projections, three are fatty and one is muscular in origin. The muscular projection is none other than the pad of vastus medialis above the patella, which is still significant in women even though it presents itself with more subtle characteristics.

On the lateral side, opposite the pad of vastus medialis, is a very characteristic fat deposit above the lateral corner of the patella that makes a more uniform and less clearly defined projection: the suprapatellar fat deposit. This fat deposit is not seen at all in men. There should be no confusion here with the relief formed by the lower end of the vastus lateralis, which is often seen in men, and is located significantly higher: several finger-widths above the patella. The two lower projections are caused by balls of fat tissue below the patella that rejoin each other on the median line as a transversal relief, emphasized by a crease that cuts across the patellar ligament, and below which the anterior tubercle of the tibia makes its central relief.

At the lower leg, we see the subcutaneous surface of the tibia extend along the whole length of the internal side. The tibia makes its long, flat plane until it ends with the medial malleolus at the bottom. Beyond this flat plane, all the rest of the lower leg is occupied by the anterior and external muscles of the region. These merge together into a large, rounded surface that is clearly depressed at the bottom, above the lateral malleolus. On the inside, the oblique tendon of the tibialis anterior shows its rounded cord at the instep.

2. Posterior View
Figure 102, A

Profiles: The contours are naturally the same as those of the anterior side.

Planes: Regarding the planes contained between these contours, first there is the projection of the buttock, which is rather significant here because of the abundant fat that accumulates in this region. It is underlined by the gluteal fold, which is always deep near the inside edge where it rejoins the gluteal cleft, and diminishes as it moves laterally before arriving at the outer surface of the thigh. I will simply remind the reader of the great varieties that exist regarding the size and depth of the gluteal fold (see p. 155). Below the buttock, the rounded surface of the thigh tapers as it leads to the central relief of the back of the knee. This central relief is offset to the lateral side and bordered by two vertical creases that are always more accentuated on women because of the fatty lining of the skin, which also increases the depth of the flexion fold that joins them at their lower part.

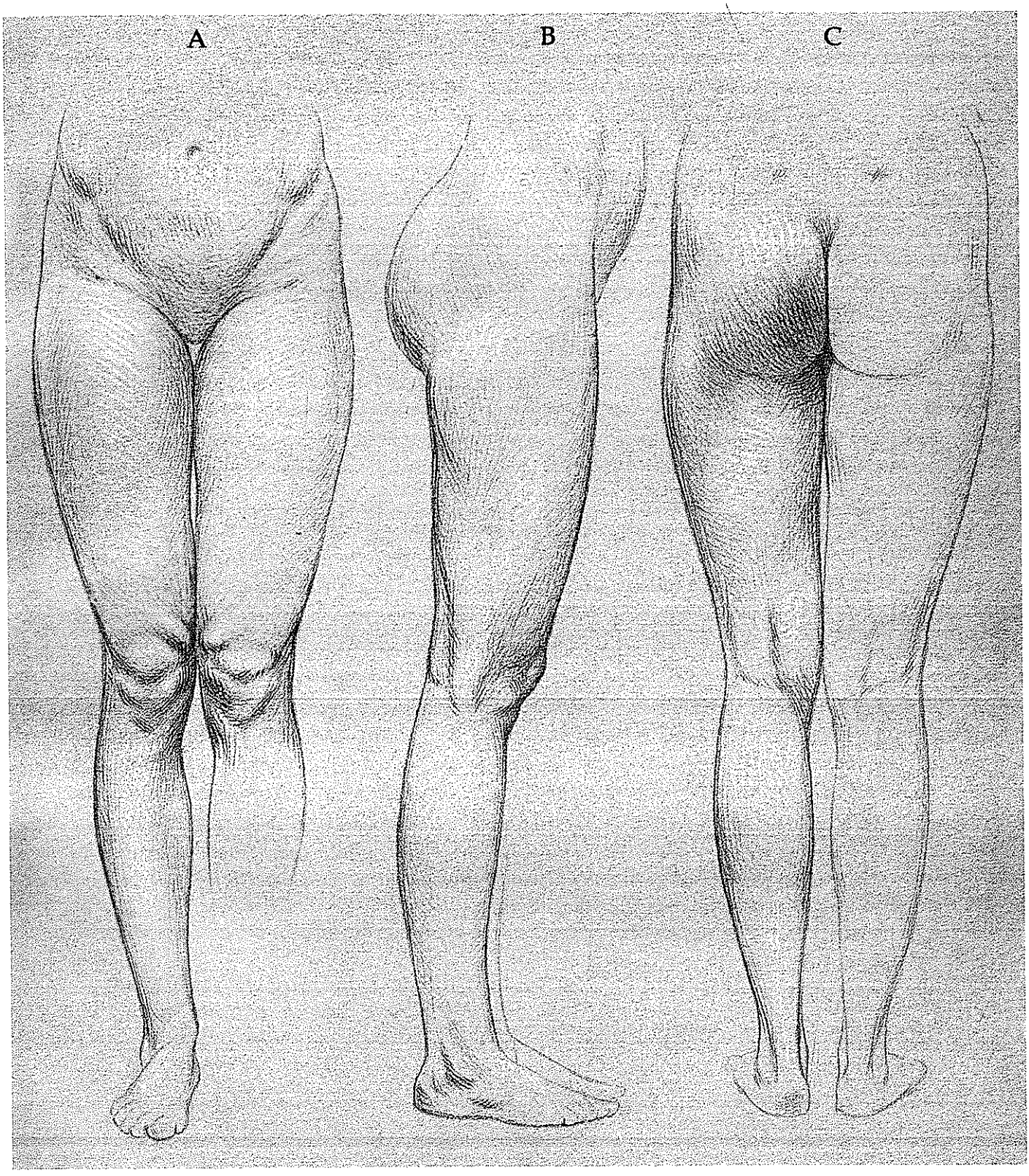

Figure 101: Feminine lower limb
A. Anterior view B. Lateral view C. Posterior view

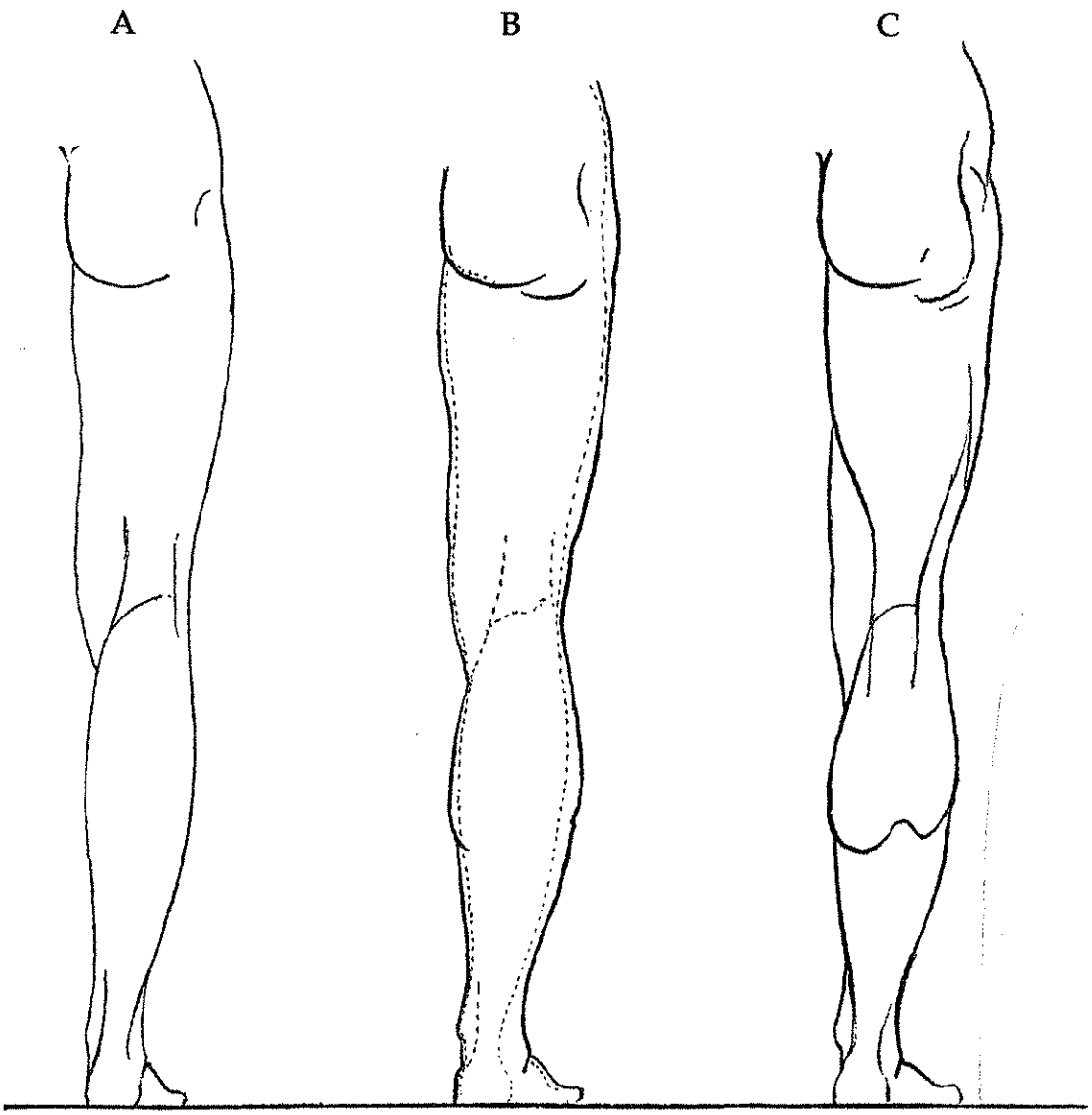

Figure 102: Posterior view

A. Lower limb of a young girl B. Superimposition of figures A and C C. Lower limb of a muscular man

The direction of this flexion fold is slightly diagonal downwards to the inside and crosses the direction of the articular plane of the knee situated deep below (Figure 103: D, H, and Figure 105, D). These different creases have several dimples along them. The two principal ones are placed along the medial vertical crease: one at the junction with the flexion fold, and the other several centimeters above it.

Below the back of the knee, the posterior side of the lower leg is a single curved surface that contains the subtle shapes of the gastrocnemius muscles, which taper as they descend to terminate at the Achilles tendon's insertion on the projection of the heel. The Achilles tendon, a fixed form, begins around the middle of the lower leg as a wide surface that receives the insertion of the gastrocnemius muscles, whose relief is only slightly apparent here. The tendon is only isolated around the lower third of its length, becoming narrowest at the level of the instep and widening again a bit above its insertion on the calcaneus. It projects most along its central part; the Achilles tendon lowers itself towards both the inside and outside of the lower leg, a bit like the two sides of a roof.

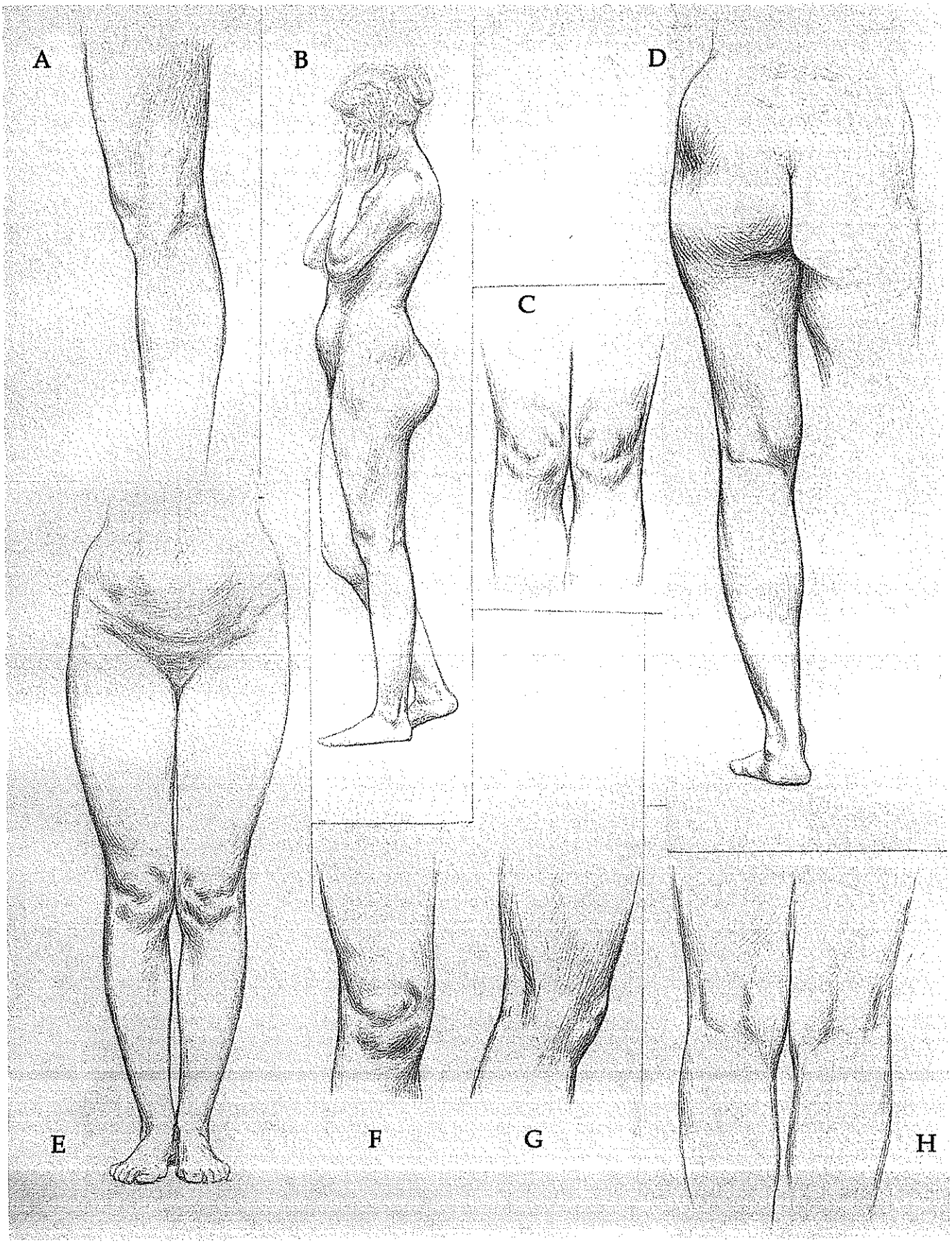

Figure 103: Lower limb

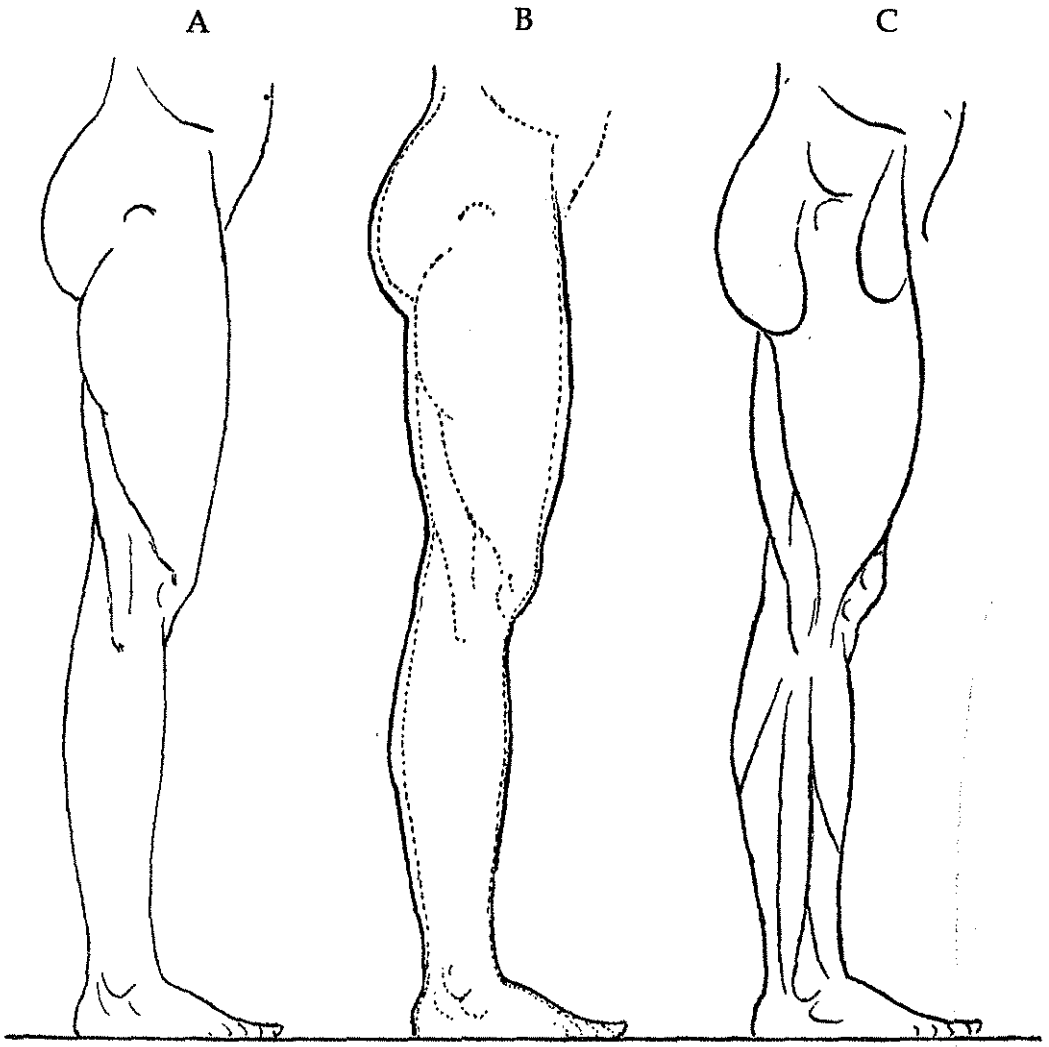

Figure 104 (above): Lateral view
A. Lower limb of a young girl B. Superimposition of A and C C. Lower limb of a muscular man

3. Lateral View
Figure 104, A

Profiles: The anterior profile descends from the iliac spine following a long, uniformly convex trajectory, only to rise slightly above the patella, where it ends in a straight line.

Figure 103 (left): Lower limb
Several examples of feminine knees on two subjects. Figures A, B, C, and D pertain to one of the subjects, and E, F, G, and H to the other. The characteristics of the feminine knee are very evident in all of these drawings. For example, one can observe a small patella surrounded by four reliefs as described on page 193. The lateral superior relief, caused by a small suprapatellar fat deposit, is very specific to women and constitutes one of the distinctive characteristics of the feminine knee (C, E, and F). The medial superior relief, of muscular origin and so characteristic of the man's knee, also appears here, although reduced in volume. The two inferior reliefs, caused by balls of fat below the patella, exist in both sexes, but here they take on special characteristics due to a greater abundance of fat in the whole region.

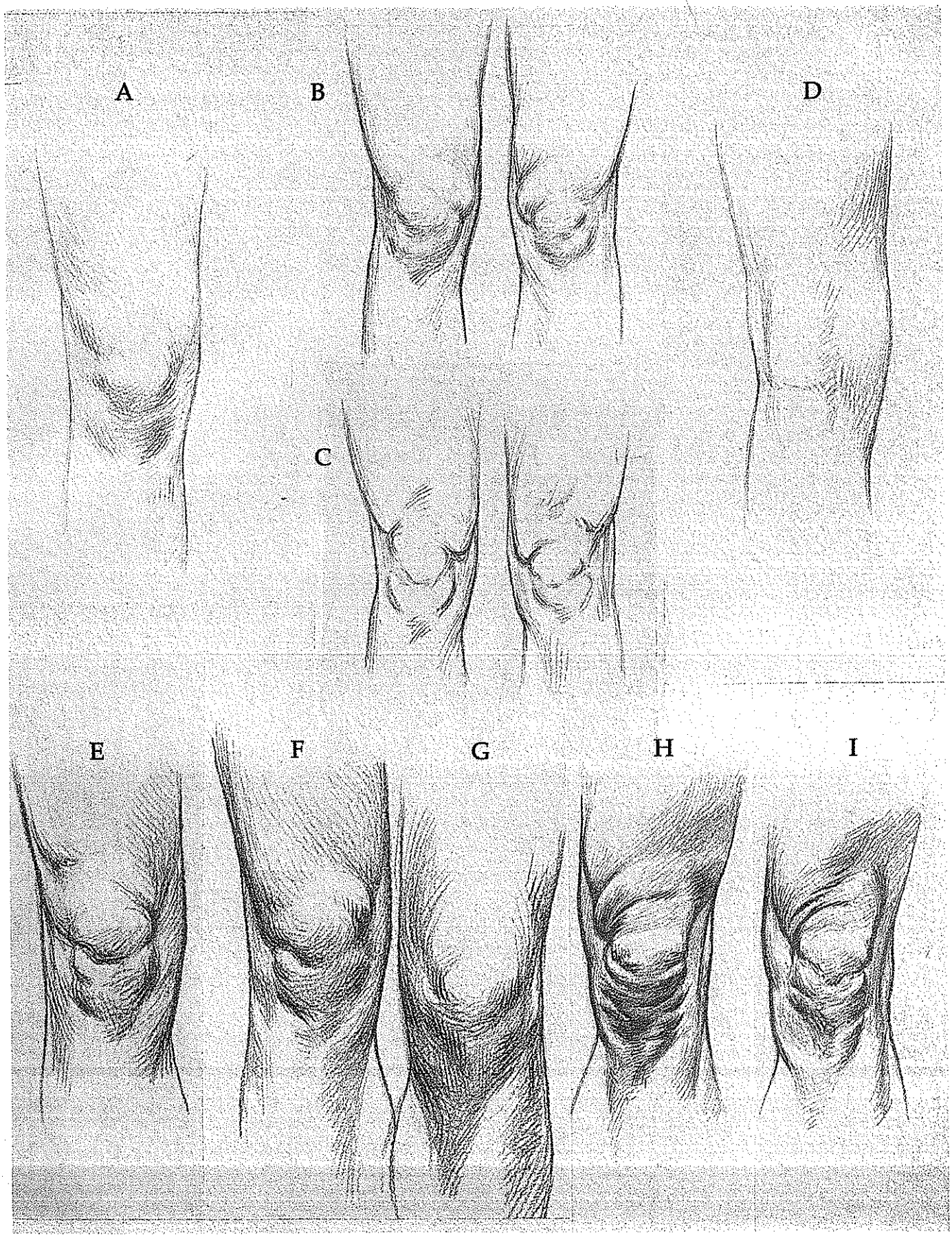

Figure 105: Other examples of feminine knees

This curve, which follows the anterior side of the thigh, is often very pronounced in women because of the fat that accumulates in this region. Egyptian artists gave it a considerable development in certain periods. At the knee, the patella makes a slight curve which is emphasized by the central depression of the patellar ligament. This, in turn, is accentuated by the relief of the anterior tubercle of the tibia that completes the bottom of the knee. Immediately below, a long convex line peaks at the middle of the lower leg, then becomes slightly concave until it reaches the ankle, to arrive almost imperceptibly at the dorsal surface of the foot, which is convex. The separation between the ankle and the foot is always more clearly indicated on antique statues than in nature. The bottom part of the contour of the lower leg that rests on the tendon of tibialis anterior, and the contour of the dorsal surface of the foot that follows the convexity of the skeleton, can both be considered as fixed forms.

In back, the contour follows the curvature of the buttock, which is always rather voluminous even when the gluteus maximus is only slightly developed, as it is in some women. The contour of the buttock finishes abruptly at the gluteal fold. I will again mention that this relief is due mainly to fat, while the longer and gentler curve that follows along the posterior side of the thigh rests on muscles. At the lower leg, a very long, uniform curved line follows the entire contour. It begins very high, above the knee, so as to include the forms at the back of the knee. It becomes concave at the ankle, before arriving at the projection of the heel, which sometimes presents two reliefs, the lower one always larger than the one just above it (a two-tier heel; see Figure 111).

Planes: The projection of the hip is caused by the gluteus medius, covered to a greater or lesser extent by a layer of fat. It leads to a depression, at the bottom of which one feels the relief of the great trochanter. The subtrochanteric fat deposit begins immediately below the great trochanter, and just below the fat deposit, the upper part of the lateral groove of the thigh, which borders vastus lateralis, always remains visible even when there is a lack of muscular development. This oblique groove begins at the posterior and superior part of the thigh and continues at the knee as a vertical furrow that divides the lateral side of the knee in two. Behind this furrow, one sees a constant surface that corresponds to the biceps femoris finishing at the head of the fibula. In front, a depressed plane rests on

Figure 105 (left): Other examples of feminine knees

The intent of this plate is to show that, between an essentially feminine knee (A and D), and a masculine knee (H and I), we see intermediary forms that appear on some feminine subjects and reunite the masculine and feminine attributes. Thus, B and C depict the knees of a young woman who is particularly muscular. In B, her knees are at rest while in C, the quadriceps are contracted. In each of these cases, one could note that these knees, which are remarkable for the development of their muscular relief, do not have any other feminine attributes due to the absence of the fatty relief at the superior lateral side. In the other example, to the contrary, F and G show the two knees in a contraposto pose. Example G is lightly flexed, while F is extended and relaxed. This posture gives the standing leg two characteristics that appear clearly: the muscular pad above the patella is well-developed and the fatty relief on the superior lateral side is very apparent and perfectly distinct from the projection of the inferior end of vastus lateralis, situated a bit above. This part of vastus lateralis separates itself clearly when contracted, as represented in E.

Examples H and J belong to a very muscular old man. He is dry in texture, and his skin, entirely deprived of fat, has lost its elasticity. It is this loss of elasticity that is the cause of the multiple creases that appear in the area below the patella during relaxation of the quadriceps, and above the patella when the muscle is strongly contracted.

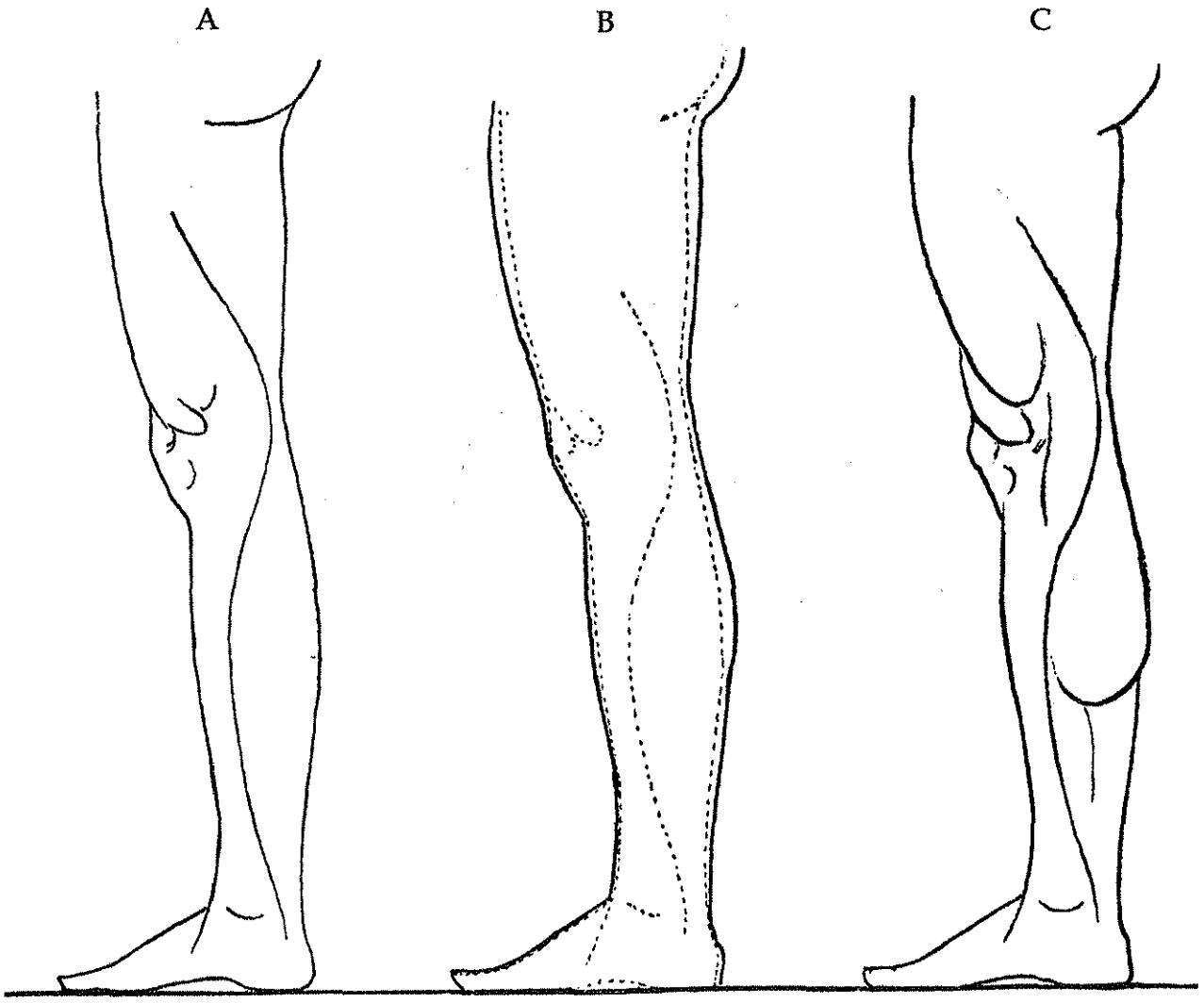

Figure 106: Medial view
A. Lower limb of a young girl
B. Superimposition of figures A and C
C. Lower limb of a muscular man

the iliotibial band. In front of this, we see the rounded relief of the infrapatellar adipose ball below the lateral side of the patella, which advances almost to the patella's anterior edge.

At the lower leg, a uniformly convex surface begins right away, supported by the muscles of the leg, which are indistinguishable from one another. This convex form ends with a depression above the malleolus due to a gap between the muscles in this area.

At the ankle, the lateral malleolus is separated from the neighboring regions in back and below by a rather broad groove. The shape of the lateral malleolus ends with a point in the middle of the region, a slight distance from the sole of the foot. At the foot, the Achilles tendon projects in back, while the relief of the extensor digitorum brevis is noticeable without being exaggerated below and in front of the lateral malleolus. The outside edge of the foot projects slightly and touches the ground along its entire length. The small bony projection of the styloid process of the fifth metatarsal is found near the middle of this area.

4. Medial View
Figure 106, A

Profiles: The contours are the same as those just mentioned for the lateral side.

Planes: The planes are the following; a long depression passes diagonally through the internal side of the thigh following the posterior edge of the sartorious. The sartorious then surrounds the entire region of the knee on its medial face, reaching the posterior contour, and continuing as a curve in the opposite direction at the lower leg. It separates the muscle of the calf from the depressed plane of the medial side of the tibia.

The medial side of the knee is divided into two parts, like the lateral side, by a subtle vertical crease that runs along the anterior edge of the sartorious. Its plane becomes even more salient when it is padded by a layer of fat, which may be considerable in some women. In front, the distinct relief of the pad of vastus medialis appears, rising diagonally over the medial corner of the patella. Lower down, the round shape of the medial infrapatellar adipose ball appears.

At the ankle, the anterior half of the region is occupied by the projection of the medial malleolus, which ends with a horizontal edge at the bottom. There is a wide groove behind and below the medial malleolus, which continues into the plantar arch. The medial malleolus is farther away from the ground than the lateral malleolus is. Immediately in front of it, we see the diagonal projection of the tendon of tibialis anterior and, farther back, the relief of the Achilles tendon.

The medial side of the foot is marked around the union of its posterior third with its anterior two-thirds by the bony projection of the navicular bone. The inside edge of the foot makes its arch at a certain distance from the ground, resting on the firm projection of the heel in back and on the relief of the metatarsophalangeal joint of the large toe in front. This side of the foot overlooks the entrance to the plantar arch.

C. Lower Limb of a Male Athlete
Figure 107

On the leg of a muscular man, the fixed forms will not change from those on a woman's leg, which I have just described. At most, the bony forms will be more solid because of the greater volume of the skeleton, but their placement and their general shape will not change. The skin folds and tendinous projections will be found in the same places. What will change are the variable forms: the cutaneous and muscular forms. The fatty forms will disappear in certain places; in some places it is as if they are absorbed by the muscular forms. These muscular forms will be exaggerated, and may subdivide themselves in some places. But they will always go in the same directions since their points of departure, their origins and insertions, begin and end on the fixed forms of the bony prominences.

1. Anterior View
Figure 100: B, C

Profiles: The internal contour of the thigh does not change as a whole; the upper part only rises slightly because if the muscular mass is considerable, then the fat almost completely disappears. However, the lower part of the thigh is shaped by a larger vastus medialis. At the knee, the profile does not change significantly because if the skin has less fat underneath it, then the skeleton is a bit more voluminous. The contour follows the bony forms more closely at the knee. At the lower leg, the contour swells out and divides in two: the first inflection determined by the medial head of gastrocnemius, and the second by the medial edge of soleus. The projection of the medial malleolus appears greater.

At the external contour, the curve of gluteus medius is more pronounced and a slight projection of the tensor fascia lata becomes apparent, which hides the great trochanter situated immediately behind it. Then, the lateral side of the thigh makes its long, uniform relief, absorbing the swelling of the subtrochanteric fat deposit and tapering as it arrives at the outside of the knee. Here, the development of biceps femoris augments the lateral contour of the knee. The contour continues below the knee with the long curve that surrounds the lower leg and divides itself in a similar fashion as the internal contour: the first portion corresponds to the outside edge of soleus, the second to the plane of the peroneus group. This contour ends with the projection of the lateral malleolus, which is just a bit sharper than the medial malleolus.

Planes: Below the iliac spine, muscular development accentuates the femoral triangle. This depression is created by the tendons of the two muscles that attach there: tensor fascia lata and sartorious. Their muscle masses indicate themselves in very different ways. The tensor fascia lata makes a diagonal relief that distinguishes it from the gluteus medius and descends until the great trochanter. The sartorious extends as a large depressed plane that cuts diagonally through the anterior side of the thigh and arrives at the posterior half of the medial side of the knee, where it makes a distinct relief. At the thigh, one finds the projection of the adductor group of muscles above and within this plane of sartorious. Below and outside of the plane of sartorious, there are the visible quadriceps, which are especially distinct in contraction. The vastus lateralis extends on the outside along the entire length of the region, the rectus femoris in the middle, and the vastus medialis, with its ovoid shape, on the bottom and medial side only.

The knee, whose thin skin is deprived of any fatty lining, shows forms that are more dry in texture and more clearly drawn than before, and which deserve to be described in some detail (Figures 107 and 108). Around the center, the triangular patella shows its horizontal upper edge with two rounded corners below the skin. Its lower corner disappears under the insertion of the patellar ligament and the transversal ascent of the skin rejoining the two lateral projections formed by the infrapatellar adipose balls. The patellar ligament only reveals itself during contraction of the quadriceps; in muscular relaxation, it is crossed by a deep transverse cutaneous fold. This fold becomes more pronounced as the muscles relax; their contraction has the effect of removing it completely as the patella is lifted upwards. In this case, the whole infrapatellar region has the appearance of a heart-shaped relief. Its point coincides with the projection of the anterior tubercle of the tibia, and its top, which corresponds to the two adipose balls, embraces the point of a second smaller relief, analogous in shape, formed by the patella itself.

Above the patella, a flat plane extends to meet the tendon of rectus femoris. In muscular relaxation, this plane is covered as the skin rises to unite the two muscular projections that lie on either side of it (Figure 108, A). On the outside, the projection of the lower end of vastus lateralis, rounded and depressed, is situated at a few fingers' width above the patella. On the inside, an oblique projection clearly defines the lower end of vastus medialis, taking the shape of a veritable pad whose lower end is rounded and continues onto the medial side of the knee until the plane of sartorious, at the level of the middle of the patella. Without going into detail about the anatomical causes for these individual muscular reliefs, I will repeat that the resistant sheath of fascia that holds the muscles of the anterior part of the thigh ends at about a hand's width above the patella in an aponeurotic bridle. By the constriction it imposes on the plump mass of the two vastus muscles, especially vastus medialis, it creates a groove that defines the lower relief of the muscle and separates it from the rest of the muscle that sits above. This groove varies in position and depth according to the individual, and these varieties depend on the height at which this bridle is placed and its degree of tension.

These forms disappear in muscular contraction, (Figure 108, B) because the lower end of the muscle, the only mobile portion, rises inside its sheath and the muscle mass becomes hardened, no longer allowing itself to be

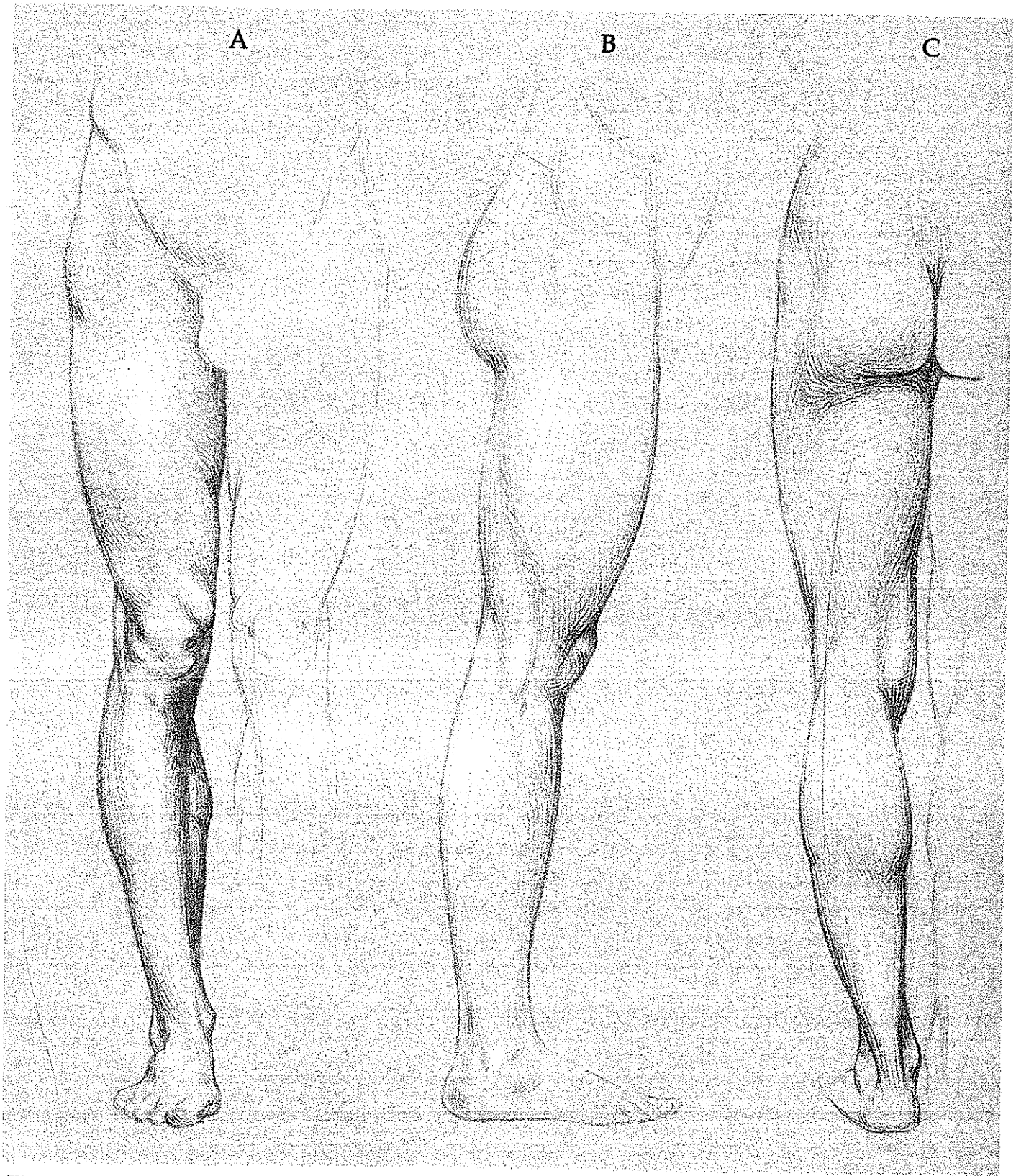

Figure 107: Masculine lower limb

A. Anterior view B. Lateral view C. Posterior view

compressed. This anatomical arrangement easily explains the formation and disappearance of these individual muscular projections and also takes note of their persistence in certain subjects during flexion of the knee. These muscular forms exist equally in women, with all their variations, although expressed in a more moderate fashion.

The plane of the internal surface of the tibia runs through the entire height of the lower leg, beginning at the knee and ending at the medial malleolus. Behind the plane of the tibia appear the distinct forms of the medial head of gastrocnemius and the inner edge of soleus. On the front, one sees the relief of tibialis anterior, whose oblique tendon descends until around the middle of the inside edge of the foot. In the lower half of the limb, the relief of the extensor of the toes continues below tibialis anterior. To the outside of these two superimposed muscular projections, we see the long plane of the peroneus group that extends from the head of the fibula to just behind the lateral malleolus.

2. Posterior View
Figure 102: B, C

Profiles: The contours do not change from those on the anterior side.

Planes: As for the forms contained between these contours, first there is the projection of the buttock, which is never too great, because if the gluteus maximus is developed, then the fat in the region is much diminished and the muscle does not make a large projection by itself. We know that, in men, the pelvis is often less inclined than in women, and as a result, the gluteal fold tends to be more pronounced. Whatever the depth of the gluteal fold, it always diminishes toward the outside, where it is replaced by an oblique inclined plane that rests on the most inferior fascia of the muscle and establishes the passage between the projection of the buttock and the posterior surface of the thigh. From the posterior side, we see the beginning of the lateral groove of the thigh high on the outside. In the middle, there is the projection of a group of muscles, the hamstrings, that merge together with the adductors above and on the inside. The thigh diminishes and tapers below, where it is lined with two creases: one on the inside along the edge of sartorious, and one on the outside, which is only a division of the lateral groove of the thigh. We will revisit these grooves shortly as we discuss the back of the knee.

The back of the knee (Figure 107, C) shows us cutaneous creases that do not change according to gender because they have anatomical or physiological grounds that remain the same. The two vertical grooves are determined by muscular forms, and the transversal crease, or flexion fold, will persist so long as the knee carries out its movement. Therefore, these creases occupy the same place in men as they do in women, but because of the absence of subcutaneous fat, they are less deep and contain fewer dimples. The lateral groove is deepest in men, which follows the tendon of biceps femoris down to the posterior surface of the head of the fibula. The medial groove is more superficial and makes a curve that embraces the knee with its concavity turned forward, separating it from the heads of gastrocnemius.

In men, when the limb is extended, these two grooves follow the axis of the limb to meet the flexion fold. At this point, they begin to deviate from the axis of the limb and are followed by two clearly marked flat planes that continue in a straight line below the flexion fold; these planes are created by the superior fascia of the insertion of the gastrocnemius. By extending the grooves downward, they give the lines at the back of the knee the appearance of the letter H (Figure 107, C).

In the middle part of the back of the knee, between the two vertical groves, we see a muscular projection that enlarges itself both above and below the knee, and is continuous with the posterior side of the thigh and with the calf.

The calf shows the distinct relief of the two heads of gastrocnemius, whose inferior insertions on the Achilles tendon are of different shapes. The medial head is more voluminous and encroaches on the inside edge of the tibia. It descends a bit lower than the lateral head, and its lower edge is rounded. The lateral head is less powerful and does not exceed the projection of the muscles on the outside of the calf. Here, it tapers to a point as it attaches to the Achilles tendon.

The plane of the Achilles tendon is wide at the top. It merges with the edges of soleus on both sides, which supports the calf. Depending on the degree of development of the soleus, the bottom half of the lower leg may be broad or tapered. On the bottom, the Achilles tendon and the projection of the heel do not differ from the forms that I have already described.

3. Lateral View

Figure 104: B, C; Figure 107, B

Profiles: In this view, the contours follow the planes that we have studied on the anterior and posterior sides. They are more similar to the corresponding contours on the feminine leg than those we have already discussed.

Thus, the anterior contour simply accentuates its curve around the muscular portions of the quadriceps in the thigh and the tibialis anterior at the lower leg. The contour will remain essentially the same at the knee, the bottom third of the lower leg, and at the dorsal surface of the foot. The posterior contour will be similarly accentuated at the buttock, the thigh, the back of the knee, and the calf, although it will remain nearly the same at the Achilles tendon and the heel.

Planes: Regarding the planes, they are remarkably more detailed in an athletic man. At the hip, one observes the rather modest bony relief of the great trochanter at the bottom of a wide depression determined by the projections of the neighboring muscles. In back of the great trochanter, the depression is even more pronounced.

The entire outside surface of the thigh is occupied by the wide plane of vastus lateralis, covered and bridled by the aponeurosis of the iliotibial band, and bordered in back by the very pronounced oblique shape of the lateral groove of the thigh.

The forms previously mentioned on the outside of the knee are accentuated: in the middle of the lateral side, the median longitudinal groove; in back, the elongated relief of the biceps femoris; and in front, the more depressed plane of the tibial fascia.

In the lower leg, it is important to mention the vertical plane of the peroneus group around the middle of the region, marked by a depression at the beginning of the tendon of peroneus longus. In front of this plane and separated from it by a groove, there are two other superimposed muscular planes. On top, we see the form of the tibialis anterior, underlined by a flat plane at the beginning of its tendon. Below it, we see the form of the extensor digitorum. Above the lateral malleolus, the two muscular planes which have neighbored one another until this point, separated only by a groove, spread apart leaving the lateral malleolus exposed. The extensors pass in front, the peroneus group in back. A constant depression exists at the point where the two muscles reveal the bone, whose role is important in the drawing of the lower leg.

At the foot, only the relief of the extensor digitorum brevis is increased.

4. Medial View

Figure 106: B, C

Profiles: The profiles are the same as before.

Planes: Muscular development accentuates the long, sinuous line that runs through the medial side of the thigh in its entire length. First, this line follows the oblique plane of the posterior side of the sartorius to surround the knee in a curve of anterior concavity. Then, by another curve in the opposite direction, it circumscribes the medial head of gastrocnemius and the internal edge of soleus to finish in the depression below the medial malleolus.

In its anterior half, the dry and muscular knee shows the bony projections of its skeleton: the medial tuberosity of the femur and medial plateau of the tibia, separated by the horizontal depression of the articular plane. In front, the posterior side of the suprapatellar pad of vastus medialis makes a projection that can be more or less pronounced. Behind this, the uniform plane of the sartorius stretches out. At the lower leg, the biggest part of the inside contour is occupied by the powerful relief of the medial head of gastrocnemius joined to the medial edge of soleus, which finishes at the upper third of the lower leg. The medial malleolus, strongly projecting and clearly ending in a horizontal edge, occupies the anterior half of the ankle.

Regarding the foot itself, since its forms are almost entirely bony, it remains as it was described before. There is only an accentuation of the oblique tendon of tibialis anterior and the presence at the inside edge, below the bony structures, of the longitudinal plane of the muscles of the medial edge of the foot, which extend from the heel to the first metatarsal.

The parallel that I have established between feminine limbs with slight muscular development and the limbs of athletes whose muscles are particularly developed illustrates very well the importance of the distinction to be made between the fixed forms, which are almost always bony, and the variable forms, which are fatty or muscular. If these notions were more widely known, one would not see artists, under the pretext of making a Hercules, augment only the volume of muscles, but also that of the bones in proportion. Because, if everything is large, nothing appears so anymore. These strange creations are not even the sacks of walnuts and the bundles of radishes mentioned by Leonardo da Vinci,[47] but instead resemble inflated bladders, like wineskins full of wind.

D. Flexed Knee

Figure 108: C, D, and Figure 109

Our description would not be complete if we did not now turn our attention to the forms of the knee flexed at a right angle and at a more or less acute angle.

Let us first consider the knee of a man that is dry and sinewy.

In the movement of flexion, the patella moves laterally and no longer occupies the middle of the region. It is closely applied against the femoral trochlea, with which it seems to become one. No matter what the degree of flexion, the patella makes the apex of the angle that is described by the knee.

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[47]"It is necessary...to know in diverse motions and forces which cord or muscle is the cause of such motion, and only to make these evident and swollen, and not the others, like many who, in order to appear as great draughtsmen, make their nudes wooden and without grace, so that they seem to look like a sack of walnuts rather than the surface of a human being, or, indeed, a bundle of radishes rather than muscular nudes." Leonardo da Vinci, *The Practice of Painting,* Kemp and Walker, trans., Yale University Press, 1989. p. 130, line 333.

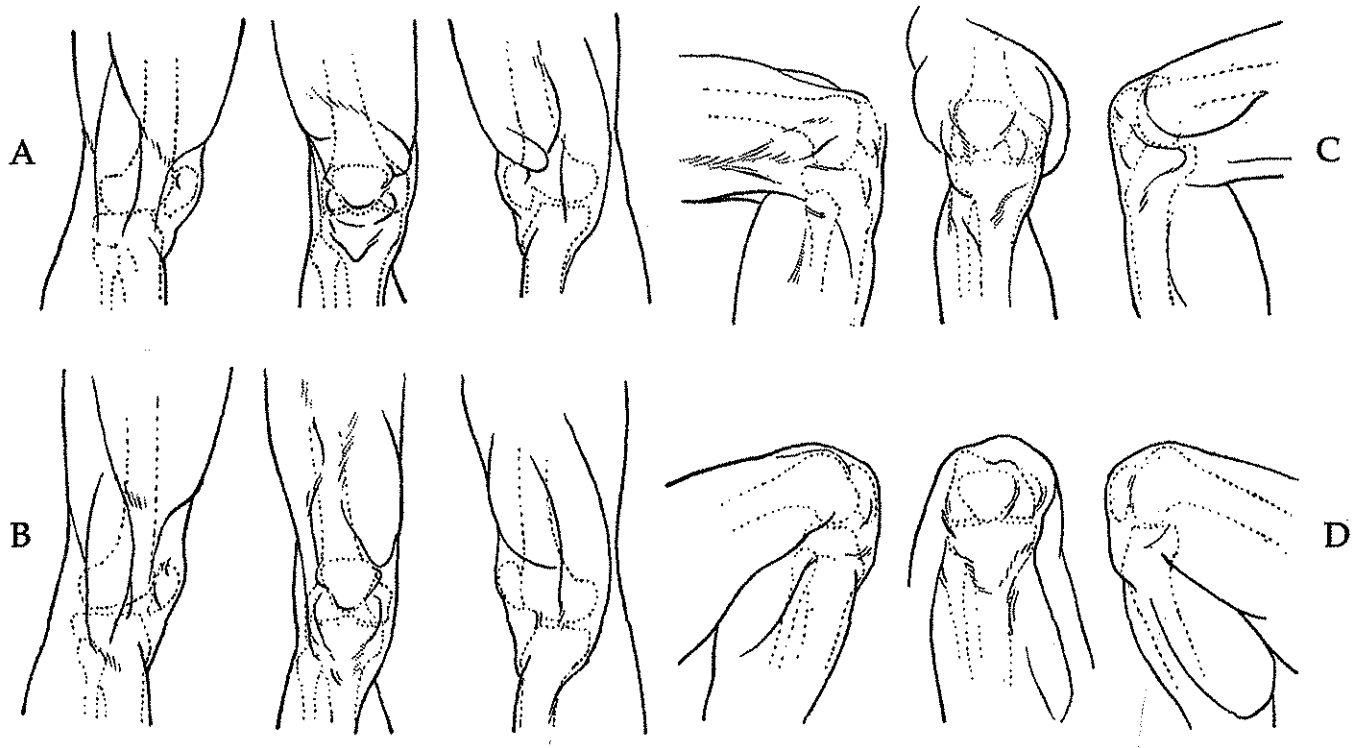

Figure 108: Masculine knee

A. Extension of the knee with relaxation of the quadriceps
B. Extension with contraction of the quadriceps
C. Flexion at a right angle
D. Flexion at an acute angle

The top of the knee shows, on the outside, a solid ridge formed by the lateral corner of the patella and the bony crest that connects the outer edge of the trochlea with the anterior side of the femur. This bony form is entirely subcutaneous, revealed by the fleshy form of vastus lateralis, whose form appears further behind. To the contrary, on the medial side, the inside edge of the femoral trochlea, as well as the neighboring part of the bone, is covered by the plump form of vastus medialis, which makes a large rounded projection that dominates the form. On a bent knee seen from the front, this results in a complete opposition between the forms of the skeleton and the forms of the nude (Figure 109, C). On the skeleton, the outside edge of the trochlea projects the furthest, while on the nude, the superposition of vastus medialis reverses the relationship and it is the inside part of the knee whose relief exceeds the others.

The projection of the patellar ligament begins from the bottom corner of the patella and ends at the anterior tubercle of the tibia. On either side of the patellar ligament, the infrapatellar adipose balls, compressed by the aponeuroses of the region, distend to form two depressible reliefs: the medial one larger and more prominent than the lateral. In addition to these multiple forms, one can easily distinguish the epicondyles of the femur and the proximal part of the tibia below the skin.

In extreme flexion, the patellar ligament flattens itself so much that it sometimes becomes a depression. In this case, the lower half of the region takes on a triangular shape, supported by the form of the proximal end of the tibia, which is revealed by this movement and becomes subcutaneous. Regarding the reliefs formed by the infrapatellar

adipose balls, one observes that, contrary to what happens in extension or moderate flexion, it is the lateral one that makes a stronger projection here.

On the lateral side, all of the lateral epicondyle of the femur and the adjoining lateral edge of the patella appear directly below the skin, surmounting the lateral tuberosity of the tibia, with the head of the fibula placed below. Between the lateral epicondyle of the femur and the lateral tuberosity of the tibia, a transversal linear depression reveals the articular plane. Behind these bony projections, an isolated muscular relief of vastus lateralis appears above, as well as vastus intermedius, the deep part of the quadriceps, revealed in this movement, along with the articular plane, by the obligatory displacement of the tibial fascia as it slides downwards. Below this, the tendon of biceps femoris shows itself very distinctly attached to the head of the fibula and overhanging the hollow at the back of the knee, visible from this side.

On the medial side, the lower part of the thigh, close to the knee, is wider than it is on the outside. The medial edge of the back of the knee descends lower because of the lower insertion of the muscles of the goose foot that create it: sartorious, gracilis, and semitendonosus. Thus, the crease at the back of the knee never appears from the medial view.

On this medial surface, one clearly sees the plump form of vastus medialis and the bony forms of the region: the medial epicondyle of the femur with the medial corner of the patella, medial tuberosity of the tibia, then, between the two, the linear depression of the articular plane. In front of the articular plane, the medial infrapatellar adipose ball makes its projection.

In women, the flexed knee shows simpler forms that the preceding description will allow us to easily comprehend. The illustrations dedicated to this subject, together with those for extension described in detail above, relieve me of making a redundant description.

Figure 109 (right): Knees at varying degrees of flexion in men and women

A. Flexion at a right angle, male
B. Flexion at a right angle, female
C. Flexion at an acute angle, male
D. Flexion at an acute angle, female

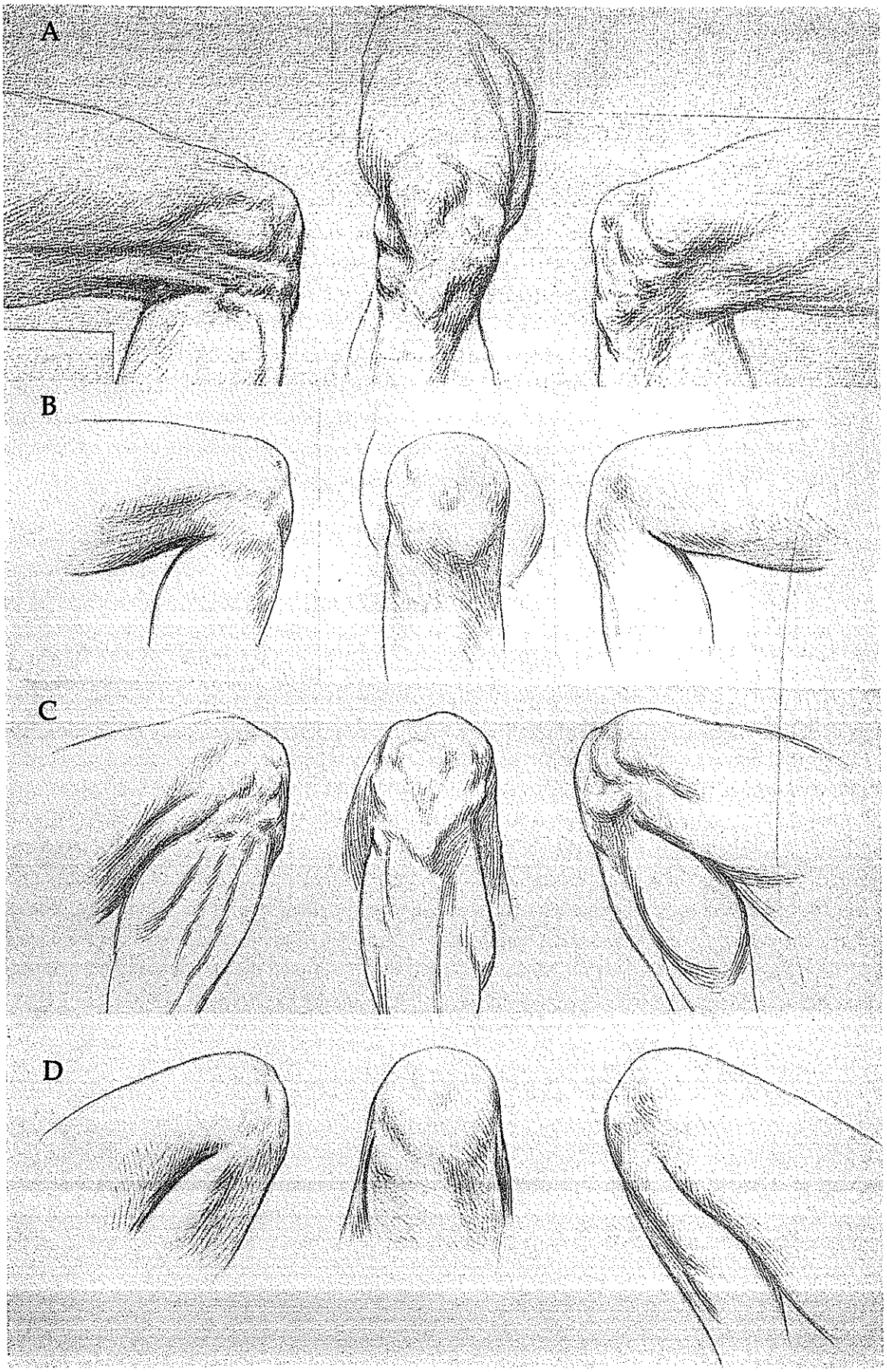

Figure 109: Knees at varying degrees of flexion in men and women

E. Foot

The forms of the foot demand to be treated separately.

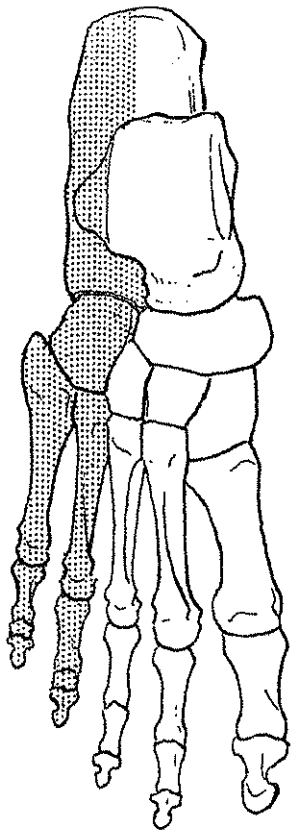

Figure 110: The two arches of the vault of the foot

At the foot, the bony forms dominate and maintain the morphology of the region, despite a reduced development of the skeleton in women. The union of the bones of the foot create a true arch, open on the inside, lowered on the outside, and supported on the ground by the calcaneus in back, the metatarsophalangeal joints in front, and the fifth metatarsal at the outside edge. Its summit is not situated in the middle, but more towards the back, and is created by the talus, upon which the bones of the lower leg sit. The dorsal surface of the foot extends itself forward of the talus. Its rounded surface tilts downward and to the outside. Its peak is not situated on the median axis, but much closer to the inside edge than the outside one, corresponding to the first and second cuneiform bones articulating with the first and second metatarsals.

From a functional point of view, the back of the arch of the foot rests its sole point of support on the calcaneus. It is subdivided into two arcs along its length; the medial arc contains the talus, navicular, the three cuneiform bones, and the first three metatarsals with the toes that join them. The lateral arc is made from the other bones of the foot. The medial arc is predisposed for movement, while the lateral arc maintains the functions of support (Figure 110).

The sole of the foot, which rests on the ground, has remarkably thick skin at its points of contact. Here, the skin is lined with a rather abundant layer of fat, which functions as a small pad by virtue of its special anatomical disposition. Thus, a thick pad spreads below the metatarso-phalangeal joints and encroaches upon the toes, which are shortened by a corresponding amount when we examine them from their plantar side. The skin presents the same characteristics along the entire length of the outer edge of the foot, as well as at the wide oval surface below the calcaneus at the heel. At the peak of the arch, to the contrary, the skin is very fine and traversed by oblique creases that are exaggerated when the foot arches itself to point the toes (Figure 113, G).

The projection of the heel, which spreads itself out on the ground under the pressure exerted by the weight of the body, is surmounted in antique statues by another much smaller relief, separated from the first by a greater or lesser interval, which seems to be formed by the lower end of the Achilles tendon at its insertion on the calcaneus (Figure 111). This disposition, which is not caused as one would think at first glance by a bulging of the tendon here, has been perfectly analyzed by H. Lebourq,[48] who stated its anatomical cause. But I will not expatiate here on this question. The important thing is to know that, although exceptional, the 'two-tiered heel' is encountered equally in women and men. Figure 111 indicates its mechanism very clearly.

[48] *Anatomie des formes exterieures du talon*, by H. Lebourq, professeur at the University of Gand. Gand, 1893

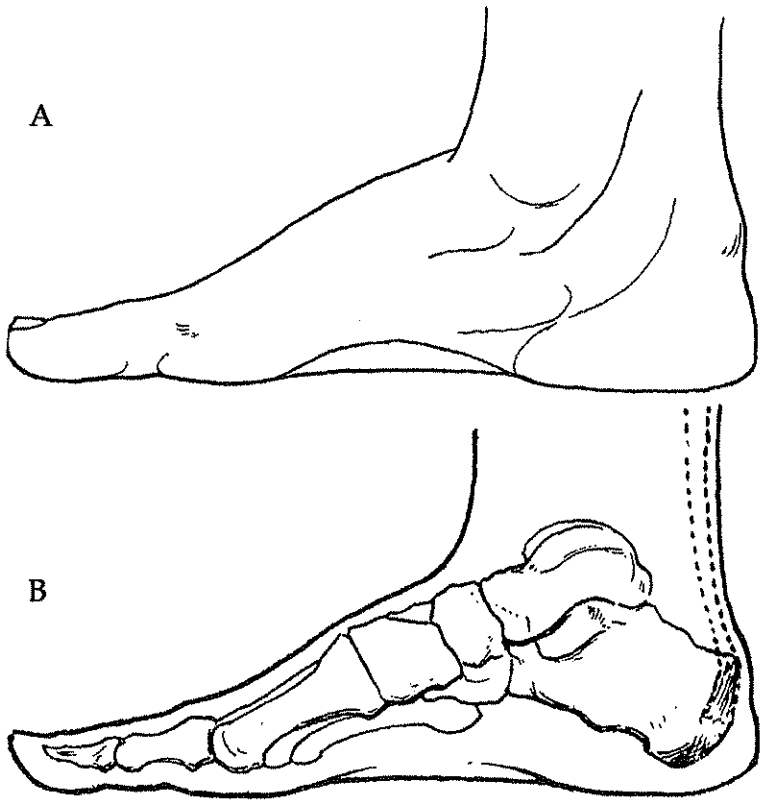

Figure 111: The two-tiered heel

A. A foot from the antique sculpture of the Faun with a child, showing the two-tiered heel.

B. Two-tiered heel in nature. It is produced, according to Dr. Lebourq, by the twisting of the calcaneus that accompanies the foot with an accentuated arch. The Achilles tendon, indicated with a dotted line, attaches itself to the inner half of the posterior surface of the calcaneus, as well as the upper part of this surface, raising the Achilles tendon above its insertion, which causes the upper bulge of the two-tiered heel.

The toes, much shorter than the fingers of the hand, nevertheless present analogous characteristics. The large toe is much more voluminous than the other toes, and is separated from them by an interval through which the ancients used to pass the laces of their sandals. Our shoes necessarily alter the direction of the toes and make them sit closer to one another. Because of the compression to which they are subjected, the toes undergo a true lateral flattening. This is another part of the acquired deformations of the body I have observed, here, affecting the direction of the toes.

The large toe does not continue in the direction of the first metatarsal, which forms the inside edge of the foot. It inclines itself a bit laterally, towards the median axis of the foot (Figure 112).

This disposition, which is certainly exaggerated by the wearing of shoes, exists to a very obvious degree on antique statues. The second and third toes are roughly parallel to the first. When extended backwards, the axis of the large toe will arrive at the medial malleolus. The fifth toe follows an opposite direction; its axis converges with those of the adjacent toes, and if extended forward, will meet them at approximately half the length of the foot. Regarding the fourth toe, it follows a variable direction: sometimes similar to that of the second and third toes, sometimes parallel to the fifth. Most often, one will find the fourth and fifth toes parallel on antique statues.

One also notices, on antique statues, that the small toe is raised and does not rest on the ground. I have had the opportunity to observe this conformation on several subjects, in particular on a young peasant boy in wooden clogs who had never worn shoes (Figure 113, H).

	Women	Men
Large toe longest	69 %	73.3%
Equality between first and second toes	13 %	10 %
Second toe longest	18 %	16.7 %

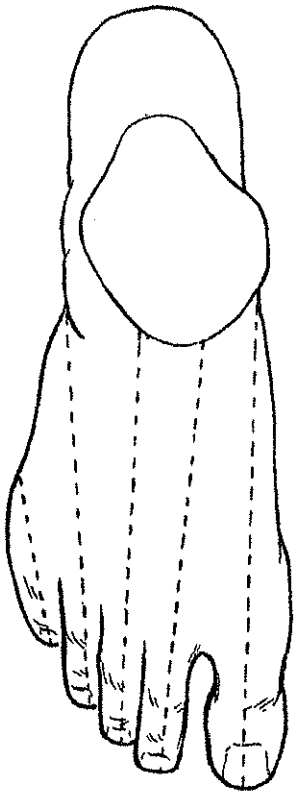

Figure 112 (above): Directions of the axes of the toes. *Their lengths are relative.*

Like the fingers of the hand, the toes are of unequal lengths (Figure 112). The first two toes fight for first position. But in most cases, the large toe is the longest, as much in women as men, though with a slightly greater frequency in men.

One finds both of these dispositions of the first two toes in antique art. From here, the third toe is shorter than the second by the entire length of its nail. The fourth does not quite reach the nail of the third, and the fifth is situated even further behind.

A woman may have a lean or skinny foot like that of a man, but generally her foot is more plump. This does not mean that she has a greater development of muscle here; rather, she tends to have a more abundant accumulation of fat in the whole region, not only on the sides and the points that rest on the ground, but also at the peak of the plantar arch, which may be partially filled. Thus, it is the dorsal curve of the arch of the forefoot where one can best judge the degree of the plantar arch, rather than at the hollow that presents itself at the sole of the foot. The depth of this hollow varies not only with the conformation of the bones, but also, as I have stated, with the quantity of fat present here.

Figure 113 (right): Foot

A, B, C, D, E, F. Foot in different views from a model, 35 years of age, with good conformation. The progress of age, and the result of putting on a bit of weight, leads to a slight protrusion of the malleoli. The only anomaly consists in the slight lateral curvature of the fourth toe. One will notice the interdigital space between the large toe and the second toe, and the direction of the toes seen from their dorsal side (F).

G. Sole of the foot

H. Foot of a peasant who has never worn shoes and presents the elevation from the ground of the fifth toe, as is often seen in antique statues.

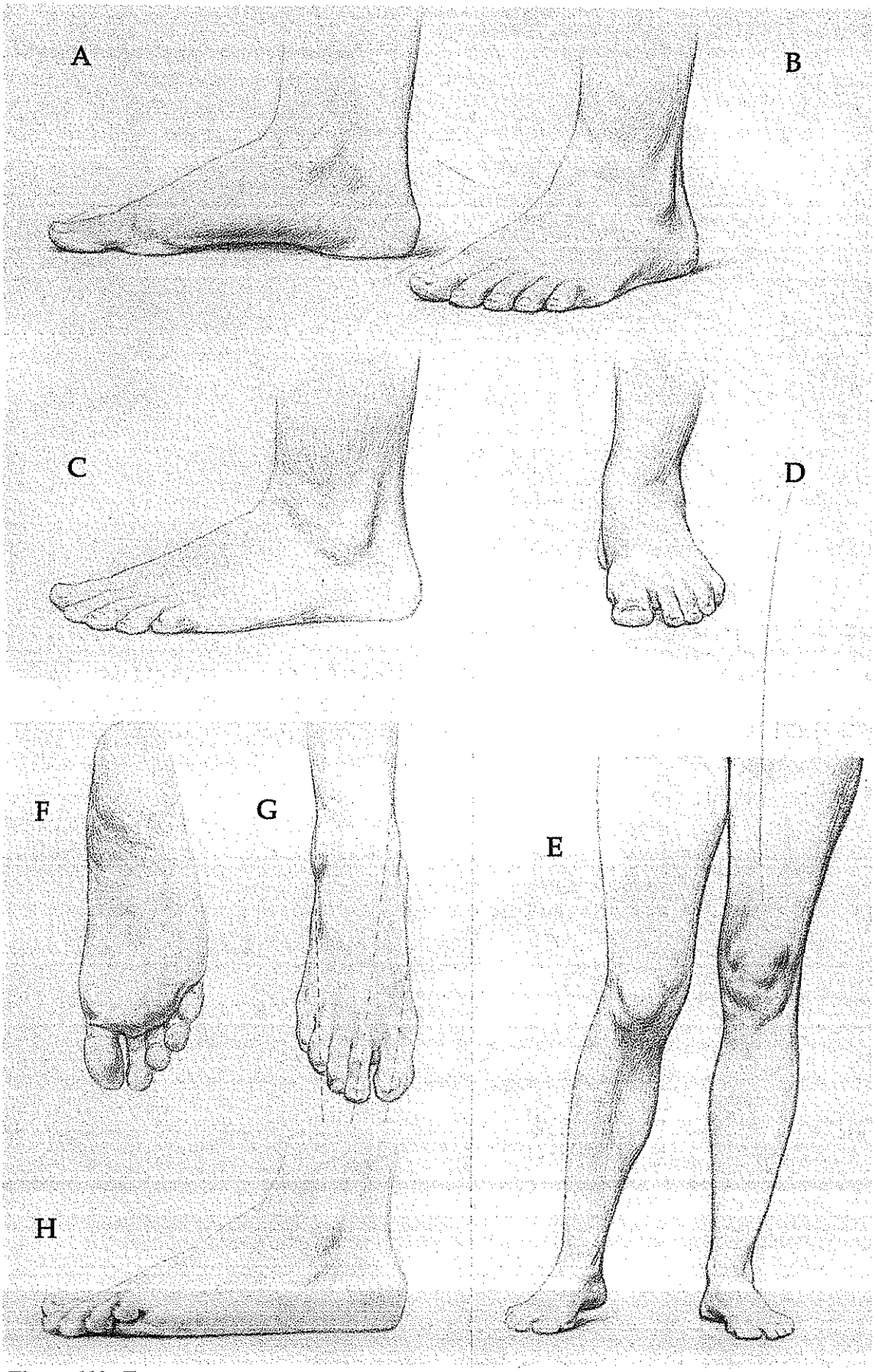

Figure 113: Foot

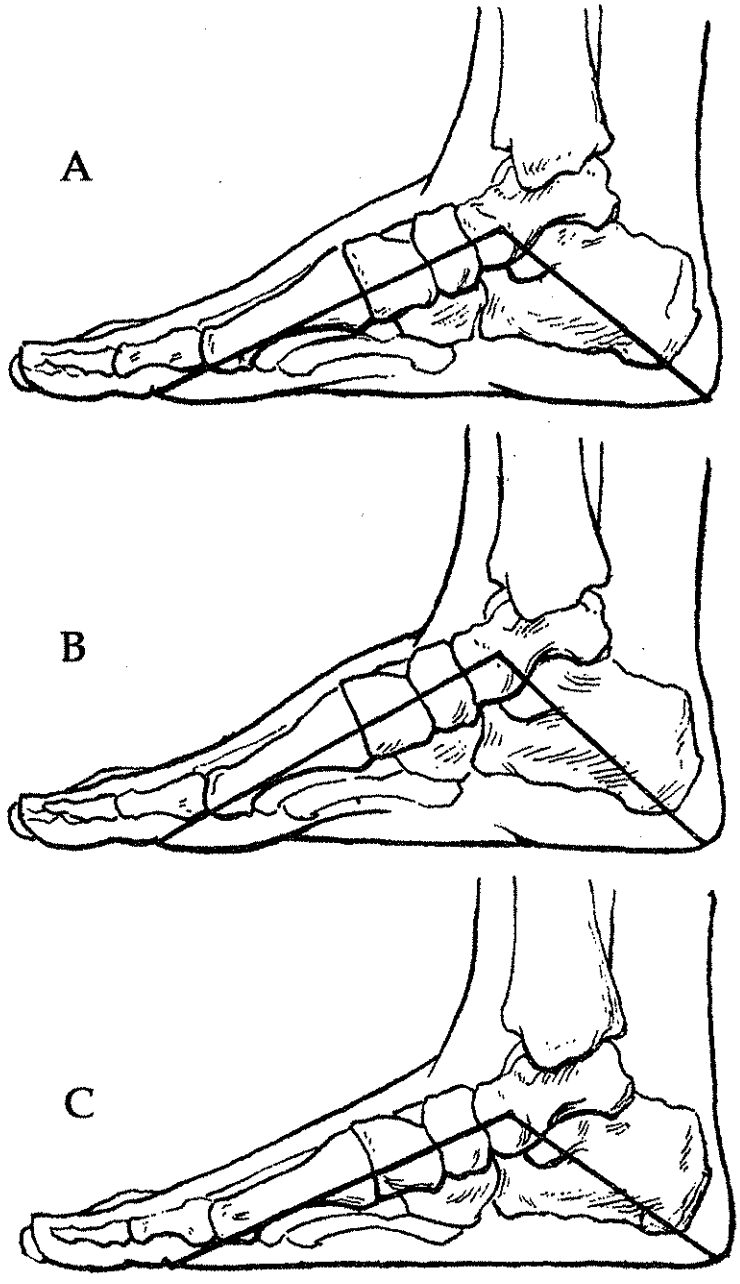

Figure 114 (left): Angle of the plantar arch
A. Normal foot: 115°
B. Arched foot: 110°
C. Flat foot: 120°

One can measure the plantar arch on the medial side of the foot by an angle whose summit corresponds to the neck of the talus, at a point placed in front and a bit below the medial malleolus. Two lines of unequal length form the sides of the angle; the posterior one ends at the posterior corner of the heel, the anterior one goes to the flexion fold of the large toe (Figure 114).

The size of this angle divides feet into three categories:

Flat feet	120°
Normal feet	115°
Arched feet	110°

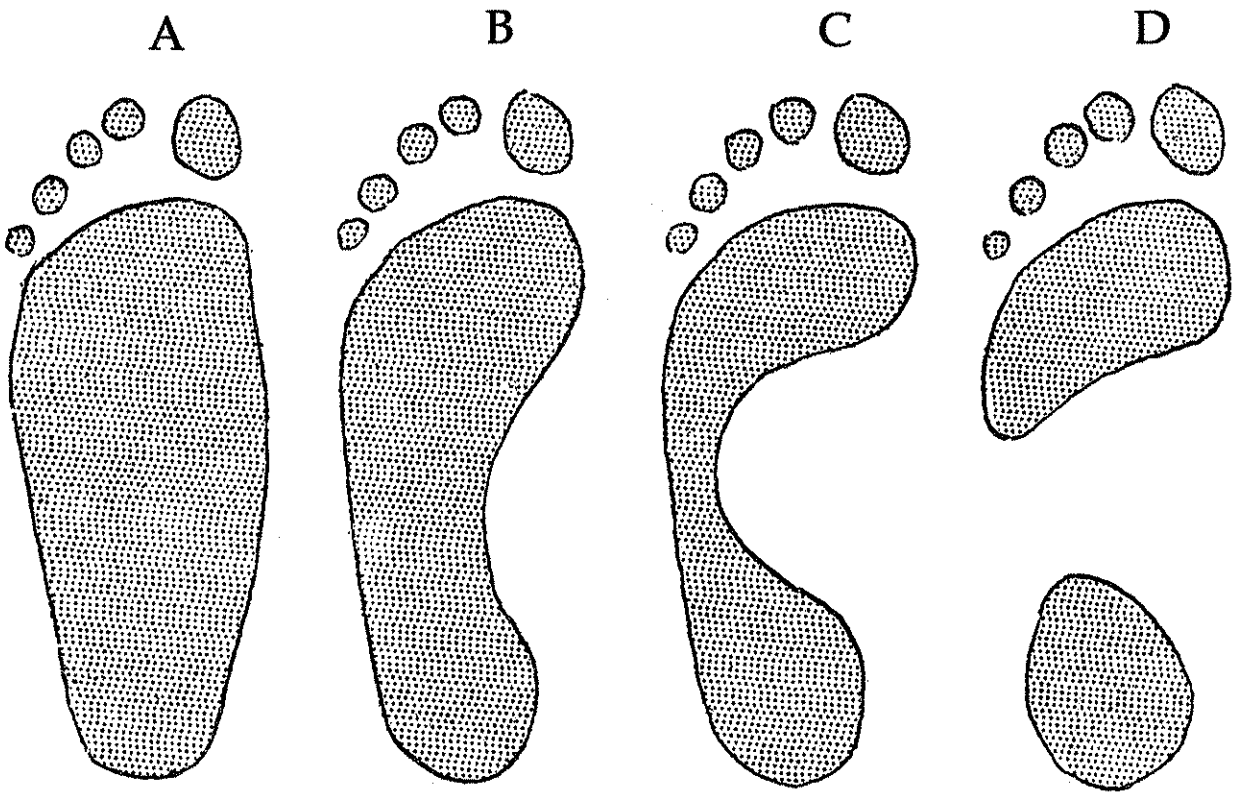

Figure 115: Footprints
A. Very flat B. Flat C. Arched D. Very arched

The footprint left on the ground is different in each of these three cases (Figure 115). In the normal type (C), the oval imprint of the heel is joined to the imprint of the metatarsophalangeal joints by a wide band that occupies the entire length of the foot and results from the pressure on its external edge.

In a highly arched foot (D), the imprint of the external edge diminishes, sometimes even to the point of disappearing completely.

In a flat foot (A and B), the footprint reproduces the entire sole and every indication of the arch disappears. When it does not have a pathological origin, the disappearance of the arch in the flat foot does not impede any of the foot's functions. The flat foot is commonly seen in peasants, and in those who walk barefoot. One also observes it in Arabs and people of African descent; it offers more extensive points of support and its solidity is assured. It spreads itself broadly on the ground and maintains all of its size.

The arched foot is relatively small. Its dorsal surface is round and projecting. It is agile. Its slight contact makes it come off the ground more easily; it is elastic. The wearing of shoes exaggerates the arch of the foot. According to Charpy, women have flatter feet than men by about 5.°

F. Several Types of Feminine Lower Limbs

Depending on the degree of development of fat or muscle, the forms of the feminine lower limb will take on particular characteristics.

One body type that is notable for its simplicity and harmony has good muscular development and a moderate layer of fat, without exaggerated fat deposits. The antique form is a remarkable example.

If the muscular element is accentuated while the fat is diminished, the form will evolve towards the masculine type. On the other hand, if abundant and clearly defined fat deposits are combined with a muscular paucity seen in some women, this will produce exaggerated curves joined to an unsightly poverty of form. And, depending on the site of the fat deposit or the muscular absence, the most diverse forms occur, among which it is easy to find the favored body types of certain artists of the Renaissance. But one will easily understand that the predominance of fat over muscle can lead to the most surprising forms, and that the artist who is somewhat informed about anatomy will always know how to avoid this peril.

VIII. Several Observations on the Drawing of Exterior Forms

Contrast Lines and Envelope Lines

In ateliers, there are some traditions that are transmitted orally regarding the design of forms, which can only gain in precision by being formulated in writing.

Regarding the contours, whose curves oppose each other in some way, one observes that in the limbs, they are arranged so that the two opposite curves are never completely symmetrical, nor can they be exactly equal in the same place. Curves that oppose each other symmetrically and similarly ought to be reserved for architecture. Artists describe certain limbs that present these defective contours as '*en forme de balustres.*'[49]

It is not the same situation for the whole body with the two legs placed together, which can be drawn in symmetrical, regular contours.

On the limbs, if two curves are directly opposite one another, then they are not of the same radius. If they seem to be of the same radius, then they are not situated directly opposite from one another. The contours have nothing geometric about them, alternately lowering themselves and rising, dividing themselves, bending in the opposite direction, transforming themselves into straight lines, etc. In short, they only obey this one general rule: *to never oppose each other mathematically as equal or inverse curves.*

Concerning the planes, one will notice that two protrusions or two depressions situated next to each other are never exactly alike or equal in size. There is always one protrusion or depression that dominates and prevails over the other by its shape or by its accent.

To facilitate the memory of forms, one can trace straight lines across the limbs that are determined by anatomical details at different points. For this reason, these oblique lines in opposite directions can be named *contrast lines* (Figure 116).

For example, in the arm, the insertion of the plump muscle fibers of the biceps onto its inferior tendon often makes an oblique line that is opposite in direction to that which passes across the heel of the hand. Likewise, at the posterior side, a line that follows the insertion of the plump forms of the triceps onto the common tendon is oblique in the opposite direction from a line that is tangent to the lower ends of the two bones of the forearm.

In the leg, the insertion of vastus lateralis and vastus medialis on the quadriceps tendon follows an oblique line that is opposite in direction to one that joins the two malleoli at the ankle. At the back of the leg, the insertion of the two bellies of gastrocnemius onto the Achilles tendon follows a line that is parallel to the flexion fold at the back of the knee, but oblique in an opposite direction to that of the ankles.

Other lines that are based on the profiles can be traced on the limbs. One could call them *envelope lines*. They are made by joining the curves of two opposing profiles with an intermediate line, opposite in direction and positioned at different levels on the limb. Thus, an envelope line describes a large italic *S* whose two ends pass along the profiles and whose middle traverses the planes.

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[49] baluster-shaped

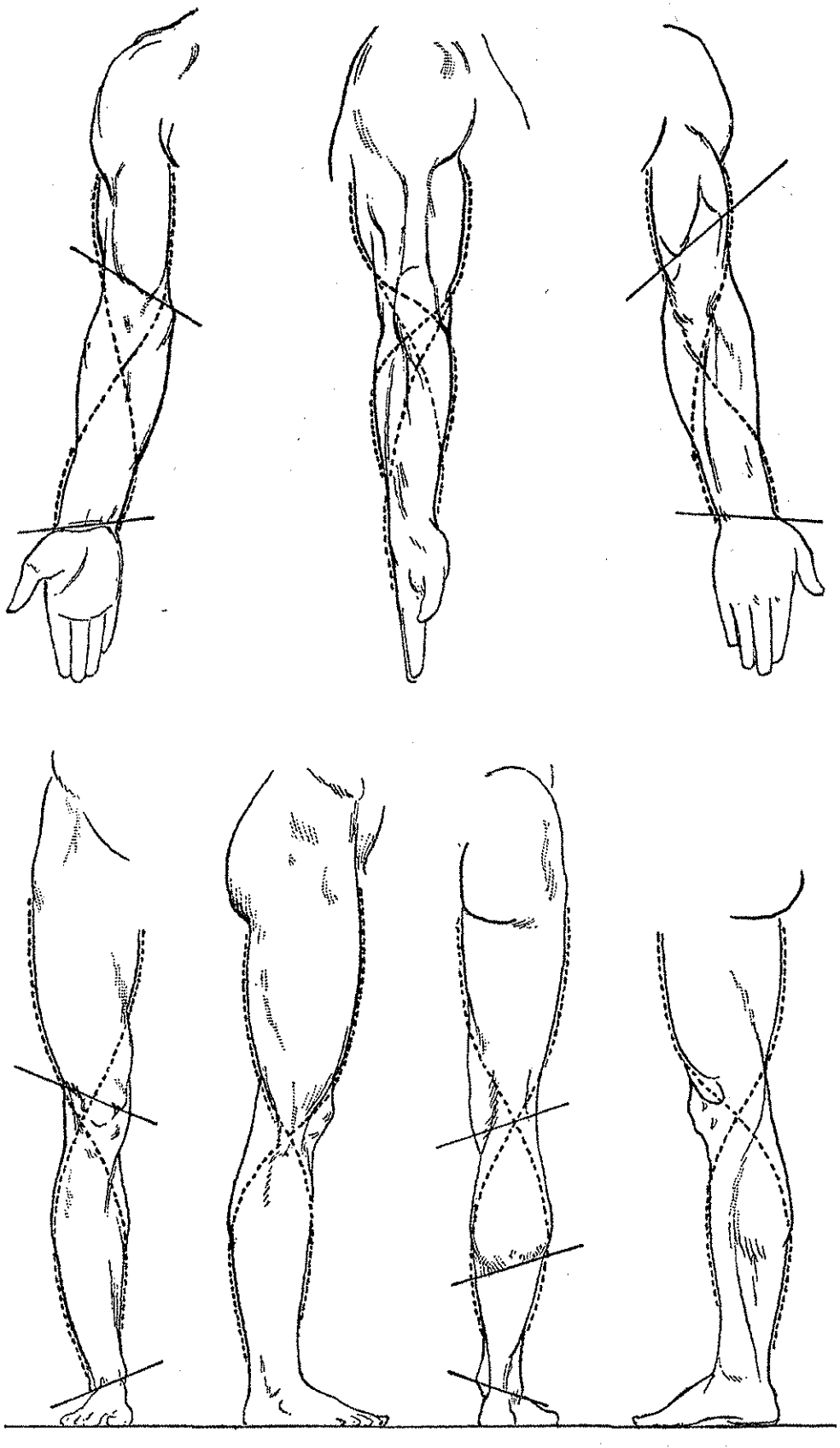

Figure 116: Contrast lines and envelope lines in the arm and leg

These envelope lines have nothing fixed about them; they have infinite variations and exist from all points of view. They can be a kind of guide for the drawing. They offer the great advantage of bringing the extremities of the model together by subjecting them to an expected relationship, and they get one into the habit of considering the whole. They help to define the shapes by making their similarities and oppositions more evident, and therefore, they help the artist to reproduce these shapes more faithfully.

They do not apply exclusively to the profiles, and even in the interior of the body some contours can join certain planes together following the same principle. Thus, they can be created on the torso or on the entire figure, no matter what its posture and movement. In sum, they constitute the easily comprehensible part of that which is generally called the *envelope* of a limb or a figure.

These envelope lines are clearly traced on the sketch by Michelangelo (Figure 117).

In his teaching, Professor Lanteri rightly insists on these envelope and contrast lines. He published a diagram that I have reproduced here (Figure 118), which is very instructive.[50]

Figure 117: Drawing by Michelangelo clearly showing envelope lines in the legs

[50] E. Lanteri, *Modelling and Sculpting the Human Figure*, London: Chapman & Hall, 1902.

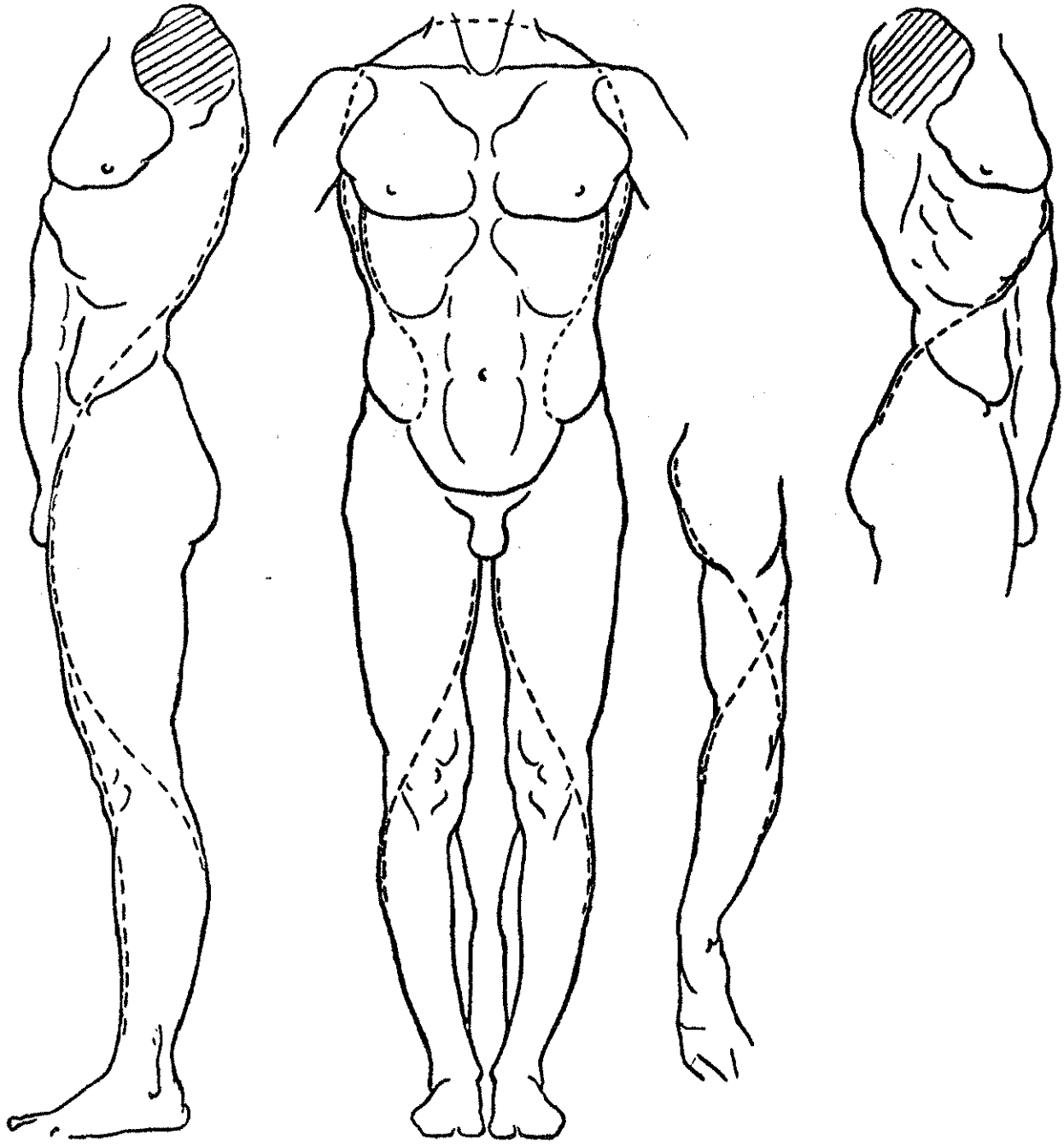

Figure 118: Envelope lines on various parts of the body, after Lanteri

APPENDIX I: TRES IN UNA

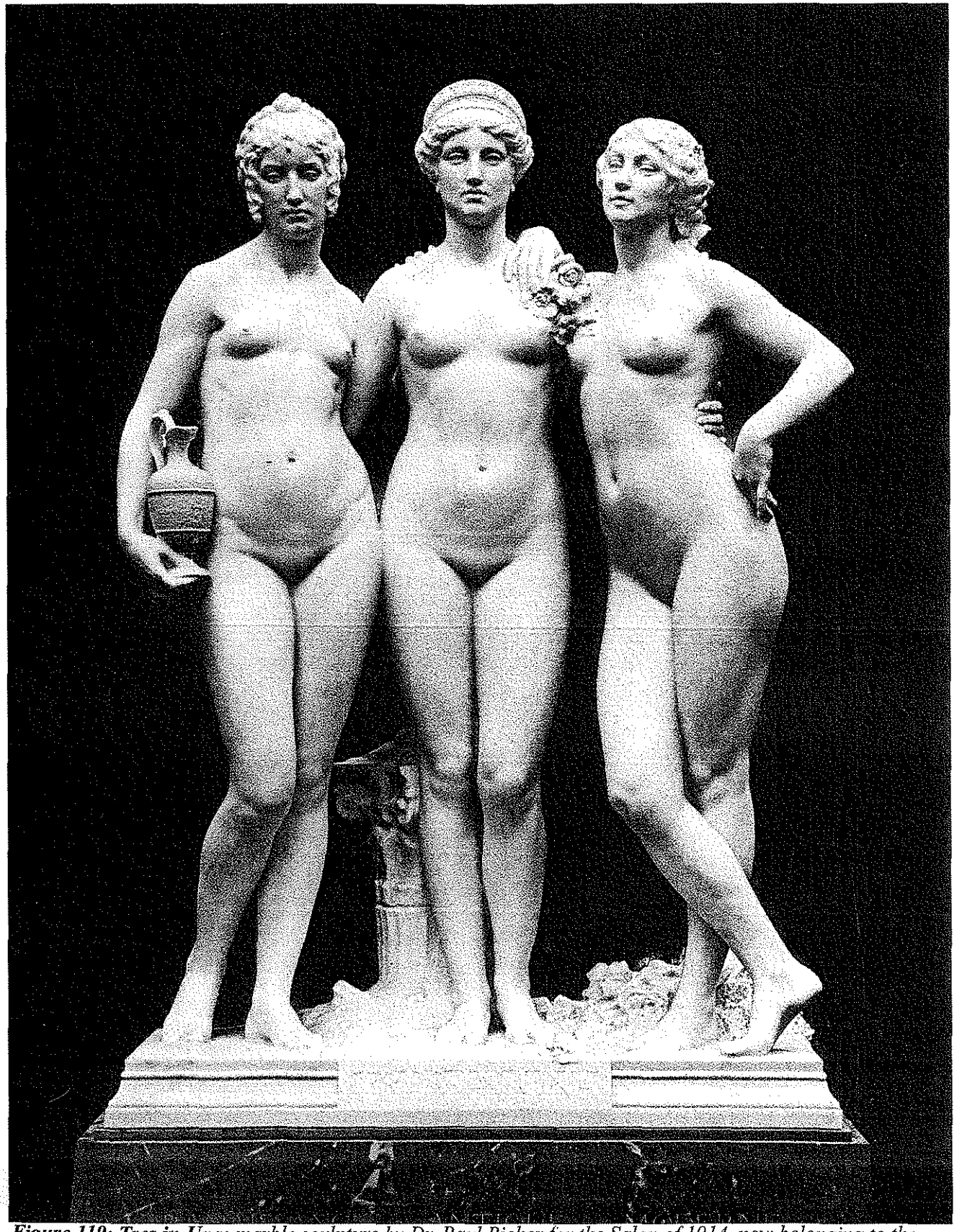

Figure 119: Tres in Una: *marble sculpture by Dr. Paul Richer for the Salon of 1914, now belonging to the City of Paris, 8th arrondissement, France. Front view.*

Figure 119 (left): Tres in Una, front view

The three women represented here correspond to three different types that prevailed in three great artistic ages: antiquity, the Renaissance, and modern times, as is evidenced by the works of artists. These types, created by art, can be found today, sculpted by nature; perhaps with attenuated features, scattered among many subjects, but nevertheless sufficiently characteristic. Perhaps the preceding pages will help artists to recognize and better appreciate them.

The figure in the center, the woman of antiquity, presents simple, harmonious forms and may be considered as the standard feminine ideal. The two other figures are diametrically opposed. For example, the antique figure has powerful round shoulders that are placed at a good level, while the shoulders of the figure on the left are sloping downwards, and those of the figure on the right are almost 'en porte manteau.' The torso, which is well-developed in the center, is more slight on the left and accompanied by small breasts. On the right, if the breasts are more voluminous, they are also placed on an average-sized thorax. The stomach, which projects moderately as does the pubis, corresponds to a pelvis of average inclination in the center figure. On the left, the stomach and pubis project much more, corresponding to a straight pelvis, while on the right, an inclined pelvis leads to the flattening of the stomach and the pubis going back between the roots of the thighs.

In the leg, the differences persist. On the standing leg, the knee is very slightly flexed on the center figure; it is in hyperextension on the figure on the left, and completely straight on the figure on the right. The extremities, the hands and feet, also have the characteristics of each age and there is no need to describe their postures and physiognomies, nor their attributes, which are designed to complete the expression of the group.

On Dr. Paul Richer's 'Tres in Una,'

by Dr. Henry Meige[51]

At the Petit Palais des Champs-Elysees, a marble sculpture was recently added representing a group of three female nudes. The unsuspecting visitor, attracted by this sculpture, expects to see a modern replica of the classical triad of the three graces; he savors the harmony of the ensemble, the purity of line, the charm of the forms. But if he seeks to look deeper into this work, he soon realizes that the forms of these three female bodies are dissimilar. It occurs to him that the work is not about a simple variation on the antique theme of the three graces, which, in all the representations made by Art, always partake of the same feminine type. And indeed, this group is not only an artistic manifestation; it is the plastic synthesis of a long series of studies on the configuration of the female body. It shows the full measure of what a sculptor's talent can achieve when supported by a profound understanding of the human form. The teaching of living anatomy, so regrettably neglected in medical education, is exemplified here.

Tres in Una, such is the name of this trio in marble, modeled by the author to extract three clearly defined plastic types from the innumerable variations of the feminine element, drawn from nature, and which art, in the course of time, has successively appropriated (Figures 119, 120, 121).

The figure in the middle summarizes the modeling of the female form in Greek art.

A perfect harmony unites all parts of the body. The head sits proudly on a straight, strong neck. Solid shoulders hang over a well-built torso where the breasts project, round and firm. The pelvis, which is very straight, is discretely

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[51] Excerpt from *Nouvelle Iconographie de la Salpêtrière, mars-avril 1914*, p. 118. Dr. Henry Meige , my student and friend, was one of my first collaborators in my studies of artistic morphology at the Salpêtrière.

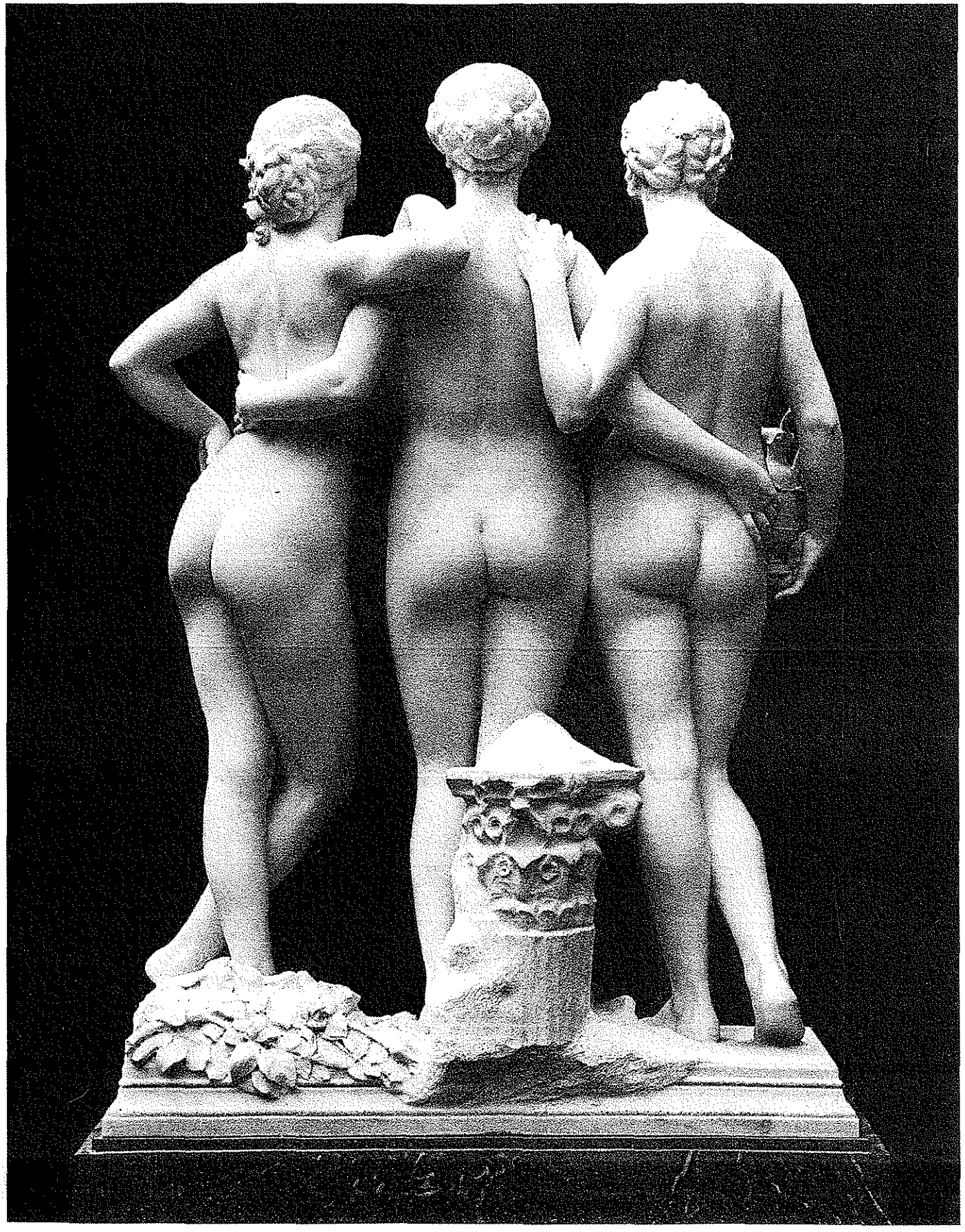

Figure 120: Back view

enveloped by the fat of the flanks; the abdomen, without flabbiness, swells slightly below the navel. Two concentric creases in the skin separate it from the mount of Venus, a sign of femininity that is accentuated by pregnancy. On a back that is well-structured, the forms of a supple and robust musculature are softly drawn, embellished in the lumbar region by two symmetrical dimples. Below, the gluteal fold clearly encircles the projection of beautifully shaped buttocks, which soften in *contraposto*.

Each of these morphological details, carefully analyzed and described by the author in his works on artistic anatomy, is rendered here with a rare exactitude and contributes to emphasize the expression of truth, health, and nobility that distinguishes the Greek feminine type. She is an image of strength and grace, an omen of fecundity. It is truly the feminine standard, from which all other types represent variations in different directions.

From the back view, the figure on the right shows us the woman of the Renaissance.

Artists from that time desired to imitate the creations of ancient art and to copy anatomical truth. The astonishing parallel development of the arts and sciences in the fifteenth and sixteenth centuries explains both of these trends. The discovery of antique masterpieces, long buried under the ruins of barbarian invasions, coincided with the first tentative efforts in dissection; by savoring the beauty of forms, one becomes interested in knowing them from underneath. Also, the nude of the Renaissance seems to be a unique *mélange* of Hellenistic elements with the first revelations of this 'anatomical nude,' whose abuse was so justly criticized by Leonardo da Vinci because the écorché competes so regrettably with antique beauty.

In the aesthetic of the feminine body of that time, one must also take into account certain corporal deformations caused by the clothing of the age. Whereas the suppleness of Greek draperies brought no hindrance to the free development of the body, the fashion of the Renaissance left indelible marks that also showed a peculiar taste for *morbidezza*, the touching charm that sickness often gives to youth.

This is why the solid harmony of the Greek feminine torso is hardly ever found in the works of art of the fifteenth and sixteenth centuries. The chest shrinks, while the abdomen takes on an exaggerated development. At the same time, the neck lengthens itself, sometimes inordinately so; the shoulders fall, the back rounds itself, the breasts are more than discrete. The entire body takes on an undulating, languid, and almost sickly quality. Witness the young girls in Botticelli's Birth of Spring, the Verite by Giovanni Bellini, the young women of Francesco Cossa in the Miracle of St. Hyacinthe, the Virgin of the Annunciation by Lorenzo de Credi, as well as his Venus, etc.

This same morphological ideal inspired the creations of Flemish and Germanic artists. The Virgins and Eves of van Eyck, Cranach, and Albrecht Dürer confuse us with torsos that are narrow at the top and ample at the bottom. It took a Raphael and a Rubens to reform this aesthetic, which was so dear to their predecessors.

Figure 120 (left): Back view

This view shows an example of the full back in the center figure, a round back on the right, and a hollow back on the left. The varying degrees of pelvic inclination lead to different orientations of the sacral surface; it is nearly vertical on the right, of average inclination in the center, and very inclined on the left. This causes the gluteal fold to be very pronounced on the right, nearly absent on the left, and of intermediate form in the center.

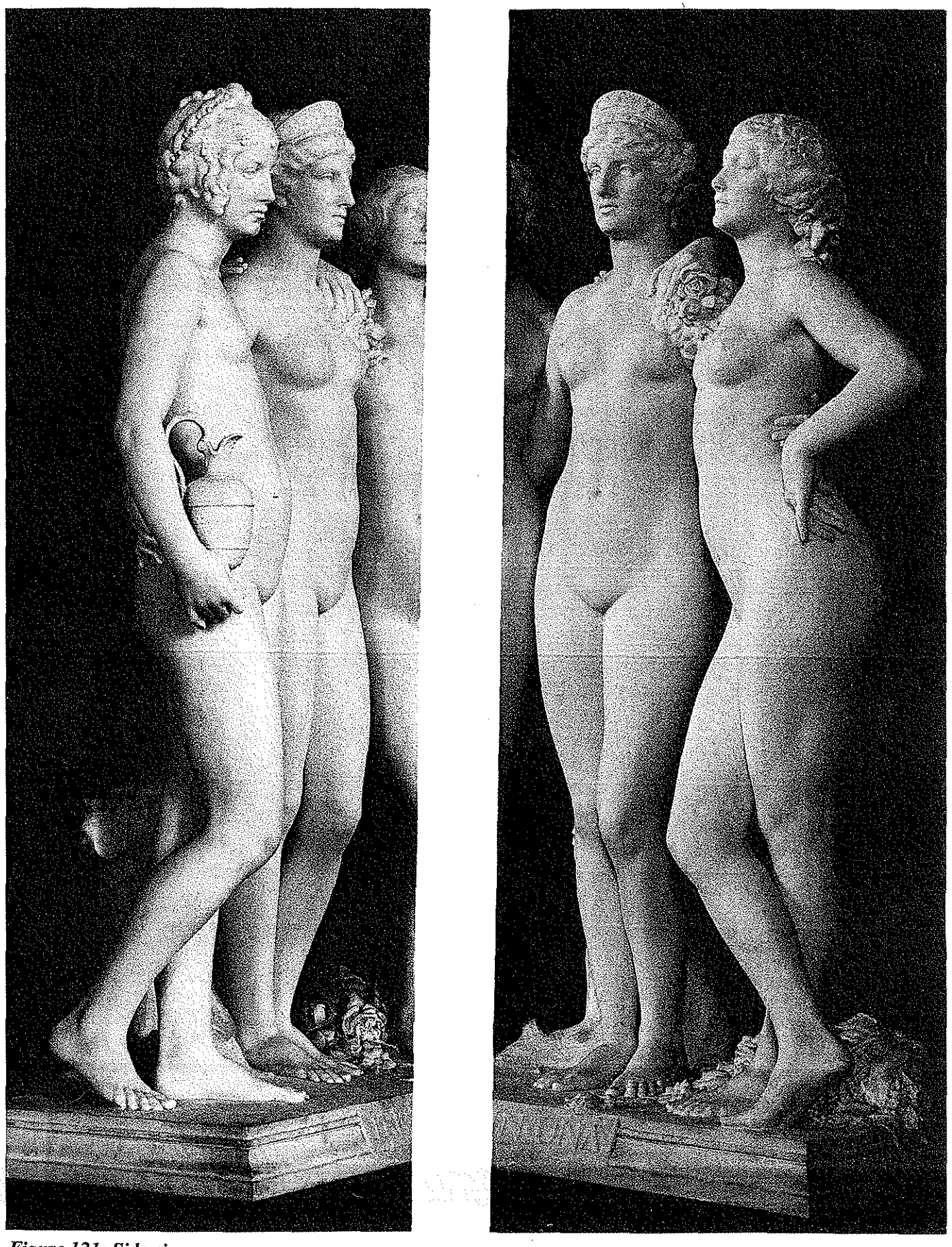

Figure 121: Side views

Paul Richer knew, in his figure on the left, to retain the characteristics of the feminine type of the Renaissance: the undulating body, long neck, falling shoulders, narrow chest, small breasts, wide hips, protruding abdomen and pubis, the nearly vertical sacral region, deep creases of the buttock, hyperextension of the knee, etc. All these characteristics are shown to advantage without compromising the charm and seduction of Italian works of art.

Nowadays, the female type is more difficult to characterize in works of art. The great number of artistic productions, the use of models of different races and more mixed types, the desire to copy nature even in its imperfections, and finally, the lack of perspective; all these causes complicate the study of contemporary aesthetics.

In the last half-century, the corset, a vulgar accessory of costume, has singularly tortured the feminine form. The abusive strangling of the waist imposed by fashion manifests itself in most of the works of art of this era by the narrowing of the lower opening of the ribcage and by an exaggerated protrusion of the breasts, the abdomen, and the hips; all aesthetic misdeeds certainly imputable to the cinched corset, which is also guilty of many displacements of the internal organs with all their pathological consequences.

A revolution advocated by hygienists, but which would not have been enough to assure success had omnipotent fashion not by chance been their ally, dethroned the cinched corset in favor of the straight corset. This new tyrant was quick to flatten the abdomen. With it, the sacrolumbar curve is exaggerated, along with the forward tilt of the pelvis. This is the predominant female type in artistic representations of the first decade of the 20th century.

The bodies of women have suffered, not only in works of art, but also in the living. The measurements by Mr. Paul Richer, made from around one hundred models, permit him to state the predominance of the inclined pelvis over the straight pelvis in this era.

The posture imposed on women by a fierce apparatus of constraint, and also the desire to adopt the fashionable figure, has certainly contributed to this deformation. Models, and artists themselves, have testified many times to their predilection for this fashionable aesthetic.

This is what the author has embodied in the figure of the modern woman, characterized by the arch of her lower back, the flattening of her abdomen, the forced inclination of her pelvis forward, and the absence of the crease of the buttock.

But fashions change quickly; the corset, no matter what kind, is now dethroned. In less than two years, the abdomen has regained its prestige. As a result, the pelvis straightens itself up, the seat deepens, the neck elongates itself and tilts itself forward, the shoulders lower themselves, the back arches itself, the chest narrows. But now, the breasts are out of favor and mercilessly crushed.

Indeed, we have the aesthetic that was dear to the Renaissance restored by fashion, though somewhat caricatured. Today's woman, wavy, serpentine, with a narrow torso and prominent abdomen, closely approaches her

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Figure 121 (left): Side views

These two views from the sides show the qualities previously mentioned from the other vantage points. Here, the goal is to highlight the oppositions between the two figures on the sides, which can be better appreciated by bringing them side by side.

ancestor, whose form is five centuries old, so that the image representing the modern feminine type already belongs to the past.

Multa renascuntur quoe cecidere[52]...

Can the feminine aesthetic of tomorrow be even more retrograde and take the antique form as an ideal, whose harmonious beauty reflects a good equilibrium between the body and spirit!

The group at the Petit Palais deserves to be attentively observed by doctors. In the rendering of the heads and extremities, in the postures, and even in the accessories, they will discover the accentuation of the individual characteristics of these women, of which I have only indicated the basic elements.

It does not undermine the qualities of this work of art to make its meaning somewhat educational, intended to teach us of the variations in the habit of the female body.

- Dr. Henry Meige, 1920

[52] Many things that have fallen are reborn...

APPENDIX II: MEASURING INSTRUMENTS

This text describes the measuring instruments used to take the data recorded in the tables in Chapter 1. It would have been found on page 34.

Each of the following tables represents, in total, the pre-printed data sheets used to record the measurements and the following information: on top, a place for the name, age, and nationality of the subject. Then, the measurements are grouped according to the nature of the instruments that were used to take them, which is indicated in italics.

A word on each of these instruments:

The subject was placed before the mobile *measuring rod* in standing posture without effort. First, the mobile measuring rod was placed in front of the subject and a bit to one side. Its upper arm descended progressively to the level of different points on the body and indicated their distance above the ground from the sole of the foot. First, we measured points situated on the front or on the side, then certain places in back were obtained either by moving the instrument or by turning the subject. These measurements could be taken quickly enough for the subject to keep completely still, a necessary condition for the regularity of the operation.

The measuring rod can be replaced by a device that requires no special anthrometric equipment. The subject is placed against a wall, on which is fixed a vertical wooden ruler. This ruler serves to guide the small side of an ordinary L-ruler, against which the large side is brought successively in line with the points to measure. This reveals metric divisions beginning from the sole of the foot.

Calipers were used for the following group of measurements. For greater ease, I obtained a specially constructed set of calipers that has the arc of a circle indicating the degree of spacing of the extremities in centimeters. The slight curve of its arms easily permits measurements on the surface as well as measurements of thickness.

The *sliding ruler* used here is the anthropological sliding ruler. It could be replaced as needed with a system of rulers and squares which is easy to imagine. One could also use the measuring rod to take the height from the bottom of the chin to the bottom of the sole of the foot.

The *measuring tape* is applied without causing constriction.

The *angular compass* is composed of two spindles articulated in such a way that they create an angle as they open. This summit is applied, for the measures taken here, at the origin of the cleft between the buttocks, or from a point at the top of the costal cartilage that corresponds to the xiphoid process, the two branches passing in the middle of the lumbar fossa or applied to the outside of the costal cartilage. The compass is then placed on the measuring sheet and the branches traced with pencil. The angle described is measured and recorded.

The *compass of inclination*, designed to give the degree of inclination of a surface against a vertical, has been specially constructed to this effect. This compass is made of a plate of wood with an arm consisting of a copper stem with a water level fixed on it. The wooden plate was placed on the sacral region and kept in position by lightly holding it with one hand. Then, the other arm of the compass was raised to the horizontal; the water level

fixed on this mobile branch of the compass permits one to obtain perfect horizontality. A graduated semi-circle gives the measure of the angle made between the wooden plate and the vertical.

The measurements indicated here could be multiplied. But one must content one's self in one's principles, and at no time abuse the good will of the subjects. Since these measurements were all taken by the same observer following the same method, they are perfectly comparable between different subjects; this was the principal result sought.

- Dr. Paul Richer

APPENDIX III: REMARKS ON THE EFFECTS OF THE CORSET

Richer had strong opinions about the deleterious effects of corsets on women's bodies and made several references to them throughout this text. Because these remarks are less relevant to our society than they were to his, I have chosen to compile his remarks into Appendix III.

- A.B.

From p. 53:

In addition to the normal body type, certain authors have wished to distinguish a costo-superior type, in which the maximum width is at the fourth rib, with a maximum depth in the middle of the sternum. The thorax is bulged out and the top of the breast is very developed. But Charpy has observed that the development of the superior half is created in detriment to the inferior half, which is notable for its narrowness. He found this costo-superior type in women who show incontestable traces of deformation by the corset on their viscera, most notably on the liver.

The abusive usage of the corset, and above all the cinched corset that has been the fashion for such a long time, alters the ribcage to the point of complete deformation, at least in its lower half. Cruveilhier has described its alterations well, which one can sum up thusly: the last ribs, turned inwards in front and above, imprint their shapes on the viscera (liver, kidneys, etc.) and displace them into the thoracic cavity. The lowering of the diaphragm in inhalation is also greatly limited, so the woman holds herself to utilize the upper part of the thorax in respiration. The strangling of the waist produces the compression of the intestine, which will in turn repress the organs contained in the pelvic cavity. It is not rare to find ridges carved by the ribs upon the liver.

In the lower half of the thorax, the anterior extremities of the sides of each rib are brought so near the costal cartilage as to become parallel. Thus, the xiphoid angle disappears, replaced by a long and narrow furrow that begins at the pit of the stomach and only expands at the level of the navel.

This is the extreme type of a deformation that does not always need to be so pronounced to be very detrimental to the health.

The fashion of the straight corset has made the great inconvenience of the cinched corset disappear, and the wasp's waist no longer enters into our ideal of elegance. The straight corset has the great advantage of freeing the epigastrum, and the lower thorax takes its point of support on the bones of the pelvis. But its danger, which is also important to avoid, is the exaggerated compression of the abdomen, in which the organs need space to develop freely.

From p. 78:

It even seems that women, not content with this variety that has been given to them by nature, contrive to augment these manifestations in an artificial fashion. It is such that, from the constant constriction from clothing on certain parts of the body, the fat ends up becoming displaced and becomes the cause of a new morphology certain to baffle the observer. One of the most curious examples is created by the compression of the corset on the middle of the torso. The fat flows, so to speak, above and below the limits of the zone of compression and produces characteristic modifications of the form around the middle of the back and at the bottom of the abdomen.

I have observed, on certain models, a type of long projecting band extending across the back above a diagonal crease caused by the radiating bundle of serratus anterior (Figure 121) whose cause is not evident. But its placement just above the upper edge of the corset, and its constant presence with the abdominal deformation, leaves no doubt as to its true cause. The strangling of the waist that often accompanies it confirms the observation. In front, the fat descends to the bottom of the abdomen, which makes an actual roll below the creases that terminate the abdomen. The groin then becomes filled with fat.

These deformations are very often observed on women of mature age, whose fat tissue is less firm and more fluid, and thus is more easily displaced.

The constriction of the garter below the knee is often the cause of a circular crease that is very detrimental to the conformation of the region. It is easy to see, by the procedure I described above, consisting of measuring the comparative thickness of skin folds in different areas, that the fat has totally disappeared just at the location of the crease left by the band, while it persists above and below, sometimes in considerable quantity. Women have this deformation more often because the knee is the site of a fat deposit, especially on its medial side, which is sometimes considerable.

From p. 158:

It is impossible not to be struck by the contrast that exists between the forms of the inclined pelvis and the ideal created in the Renaissance. Now it happens that this type of inclined pelvis, with the almost total suppression of the abdomen and the strong lumbar arch that accompanies it, is often observed today. Our modern artists have created this form with remarkable insistence, which has not been seen in the art of any other era.

Fashion is no stranger to the inclined type, just as in the Renaissance, fashion had a large part in the adoption of the type preferred then. In effect, for the past twenty years, a fair reaction to the damage of the cinched corset has led to the creation of the straight corset, which has the incontestable advantage of freeing the epigastrum and the lower ribs and taking a more logical point of support on the incompressible bony belt formed by the pelvis. But, fashion has tangled itself; the goal has been passed. In contrast to the protruding abdomen that comes from wearing the cinched corset, it was fashionable to no longer have any projection of the abdomen. The suppression of the abdomen leads naturally to lordosis of the lumbar arch, the two consequences of the inclined pelvis. And the straight corset, legitimate in the first idea that led to its creation, exerts an exaggerated constriction on the abdomen that is always harmful and maintains the tilt of the pelvis to an extreme degree.

It is certain that, in subjects with a naturally inclined pelvis, the wearing of the new corset would not be a grave inconvenience, above all if it is worn in a less extreme form. But, as fashion does not discriminate among their

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Figure 122 (right): Displacement of fat due to the habitual use of the corset

A, B & C: Dorsal band and falling abdomen in the same subject, 25 years of age; constriction of the lower ribs. The dorsal form is accentuated in certain postures, for example, in contraposto.

D, E: The same deformations to a moderate degree in a subject of 26 years of age.

F: Constriction of the lower ribcage and falling abdomen in a young subject of 19 years.

G: Falling abdomen in an older model, 45 years of age.

H: Falling abdomen in another model, 28 years of age.

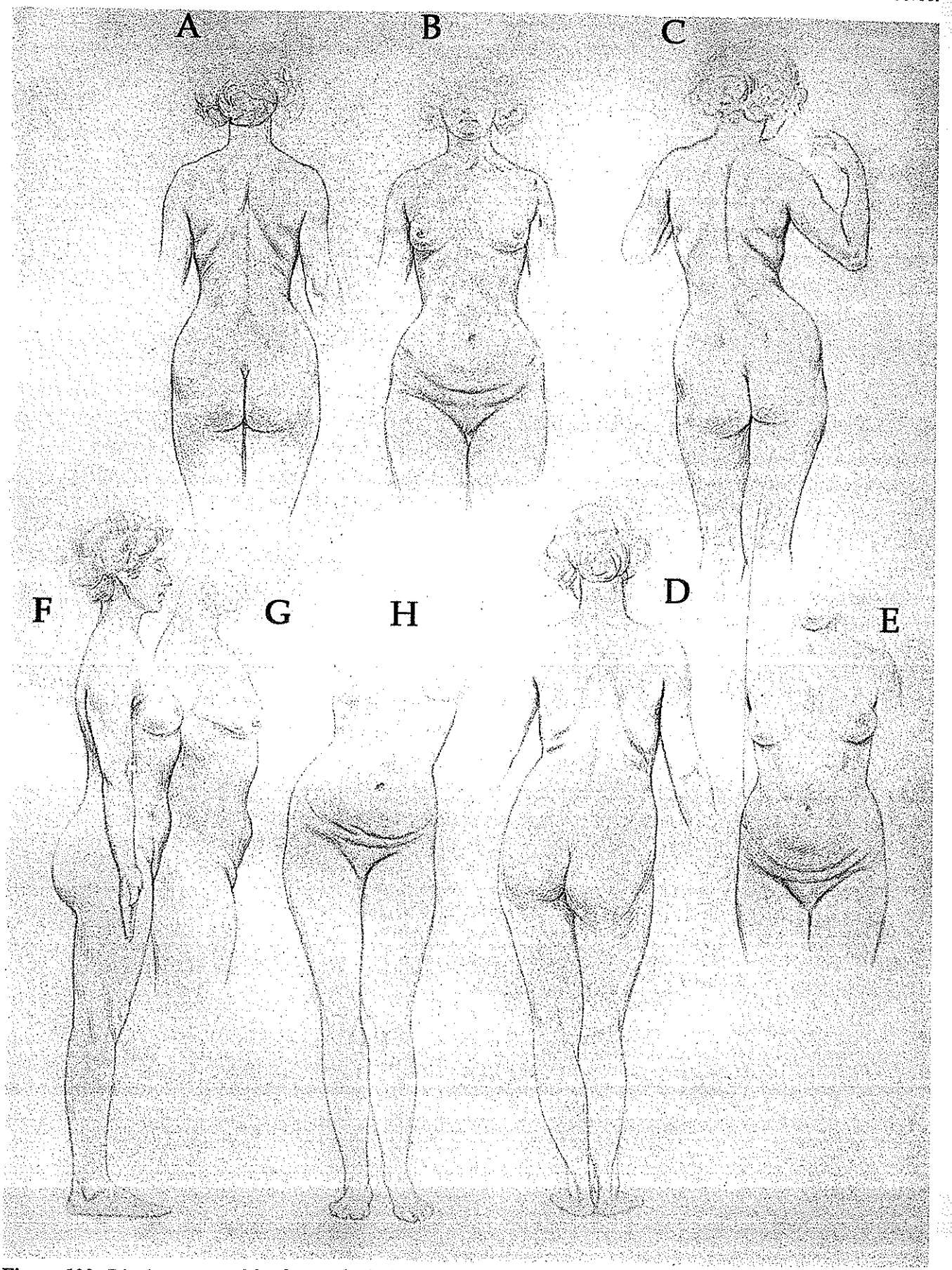

Figure 122: Displacement of fat due to the habitual use of the corset

individual morphologies, all women have to submit to the tyranny of one form. Those with a very straight pelvis, which are not rare to find, have to pay for the others, because it could only be their fatal curse to wear a corset so contrary to their natural conformation.

Why do women, in wanting to remake themselves, not look to realize in themselves the type of beauty which nature herself has predestined for them by their natural conformation, which they do not use other than to correct and contain it, but rather to develop and strengthen it by the free play of all their organs? One would then see the feminine forms; which one would not seek to remake by force or by will to one single standard, necessitating the use of the veritable instrument of torture that the corset becomes; cause themselves to bloom without constraint and freely into a variable flora, having no other limit on the conditions of the normal state and health. It is very evident that the tailor's art no longer aims to create a single model destined for all women, but different models whose goal is only to accompany and make worthy the natural forms of each one of them.

Whatever its style, the action of the corset leads to the constriction it imposes on the organs, whose gravity varies with the degree of constriction and the place where it is produced. It is more dangerous at the level of the floating ribs which allow themselves to be easily depressed and deformed with the cinched corset. It is naturally less so with the straight corset at the level of the pelvis, whose resistance offers an incompressible point of support at least on the sides and back. Not boned and simply applied to the surface of the body, it should only be used to support clothing if the woman does not find another way- straps, for example- to fill this role. Regarding the role of support or relief of the torso, which one has often attributed to it in young, weakened girls, it goes against the goal being sought, because in substituting it for the action of muscles, it can only maintain the weakness it is intended to combat. It therefore seems that its use should be reserved only for obese persons or those who suffer from clearly defined conditions such as umbilical hernia or eventration.

I know that recently, a new evolution of fashion has begun that is more in line with good sense. We have seen suddenly, around the beginning of 1913, that the line of the fashionable woman has been transformed. The abdomen resumes its normal volume and its habitual place as if by magic; the hips develop themselves, while moderating themselves in proportion to the prominence of the region of the buttocks. Will this fashion neo-Renaissance last? If yes, we can predict, without being a great prophet, a resurgence of the straight pelvis in nature and in works of art.

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-A.B.

Front cover: Paul Richer, *Tres In Una*, marble sculpture, Salon of 1914. Currently in 8th arrondissement, City Hall of Paris. Source: Carte postale, Salons de Paris, 1914. Wikimedia Commons / Public domain {PD-1923}

Back cover: detail of above

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